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THE PREVENTION OF POSTOPERATIVE PULMONARY COMPLICATIONS

Round Table Conference[1]

PRE-OPERATIVE PRECAUTIONS IN THE PREVENTION OF POSTOPERATIVE PULMONARY COMPLICATIONS

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NINETEENTH century surgeons labored courageously but under great handicaps in operating with poorly administered anesthetics, with questionable asepsis, with inadequate tools, and more often in the home than in the hospital. Extraordinary improvements in these phases of operations have occurred, but hazards still remain that threaten the patient and embarrass the surgeon. An operation is an ordeal, a battle of opposing forces, for which the surgeon and the patient should mobilize all possible aids for prompt healing. Occasionally, familiarity with certain standardized surgical procedures breeds a casual carelessness in the surgeon's attitude that invites trouble. He fails to marshal all his forces, caution is momentarily disregarded, details are neglected, or important responsibilities are unwisely delegated to others, and disaster follows. The surgeon must ever be on the alert to use every precaution and every improvement known to surgical science to insure an uncomplicated convalescence.

An important field demanding improved care and an altered surgical attitude is the pre-operative preparation of the patient. A real beginning has been made in the better preparation of the thyrotoxic, anemic, or obstructed patient. The greatly improved results in the surgical treatment of carcinoma of the bowel and rectum are in great measure due to the surgeon's willingness to spend a week or even two weeks in pre-operative preparation. Despite this recognition of its importance, many surgeons have no hesitancy in admitting patients for operation the following day, and are then disappointed when an infection or disruption of the wound, a fatal embolus, or a serious if not fatal pneumonia occurs.

The perfected care of a patient divides itself naturally into three phases: the pre-operative period, the operation itself, and the postoperative period. Just as the operation itself determines the postoperative course, so, I believe, the pre-operative preparation determines the length of convalescence. A few days spent in pre-operative care should decrease, in the long run, the number of days that the patient will spend in the hospital after operation. To admit a patient today and to operate upon him tomorrow is accepting avoidable risks that should and must be eliminated. This is true particularly when dealing with patients from the submerged

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half of the population who have been living on overcooked stews, doughnuts, and coffee; or when the patient has been following a grossly inadequate reducing diet. As Minot (14) points out: "The major problems of nutrition do not concern clean-cut deficiency diseases, but the prevention of partial deficiency. Borderline states of nutritional instability are much more common than is usually appreciated. There is a wide zone between optimal nutrition, and the level at which classic symptoms of recognized dietary deficient states develop." The undernourished, or malnourished patient with a low proteinemia, or the patient in whom the vitamin store has been depleted either by disease or by a diet lacking in essential vitamins is an example of a patient in a poor state of nutrition for the ordeal of operation.

Evidence of the importance of nutrition is available from the experimental laboratory. Ravdin (17) and his coworkers have demonstrated a high incidence of disruption of wounds in the presence of a low protein content of the blood. Observations by Lanman and Ingalls (10), confirmed by Taffel and Harvey (16), showed convincingly that "in guinea pigs partially depleted of ascorbic acid, the healing of operative wounds, both histologically and physiologically, was inferior to that of a group of control animals. The abdominal wounds of the scorbutic group ruptured at a pressure averaging approximately one-third that required to rupture the wounds of normal animals." Previous observations by Hojer (8) and by Wolbach (19) had indicated conclusively that ascorbic acid is intimately concerned with the synthesis and maintenance of the intercellular supporting materials, the all-important collagen fibers that provide the framework of healing.

Not only are the vitamins essential in normal healing, but evidence is accumulating that they play an important rôle in the prevention and treatment of infection. Green and Mellanby (4) observed that a large number of their dogs receiving defective diets died of bronchopneumonia. Young rats fed on a diet low in Vitamin A died in from six to fifteen weeks with one or more abscesses. In two groups of animals, one reared on an inadequate Vitamin-A intake, the other on an adequate ration of Vitamin A, the incidence of infection was 75 per cent in the first group, and only 25 per cent in the second group. In another group of 93 animals, deficient in Vitamin A, 91 showed some evidence of infection.

The outstanding pathological changes due to Vitamin-A deficiency concern mainly the epithelial structures and may be epitomized as an atrophy of the epithelium, a reparative proliferation of the basal cells, and a substitution of stratified keratinizing epithelium for the normal columnar epithelium. In the lungs of human infants, as well as of experimental animals, this process leads to occlusion of the bronchi, the formation and filling of bronchiectatic cavities with keratinized cells, and a resulting atelectasis. In the words of Wolbach (20): "The early effect of the deficiency on the respiratory mucosa is a satisfactory explanation of the frequency, severity, and persistence of the pneumonias that have been in most instances responsible for death in Vitamin-A deficient infants."

The significance of the vitamins in relation to infection is further manifested by their increased consumption in the course of an illness. Abassy, Harris, and Ellman (1) state that "pulmonary tuberculosis provides the most extreme example of the increased consumption of Vitamin C. The daily excretion for a standardized diet falls to about one-third the controls, and the response to three days testing dose is negligible." Martin and Heise (13) demonstrated the existence of a hypovitaminosis due to a lack of Vitamin C in a large majority of tuberculous patients, and the degree of hypovitaminosis was found to parallel the extent and activity of the tuberculous process. Greene, Steiner, and Kramer (5) showed that generalized tuberculosis developed more rapidly in animals chronically deficient in Vitamin C than in non-scorbutic animals, and that chronic Vitamin-C deficiency combined with a tuberculous infection causes a significant shortening of the survival period. Leichentritt (11) gave large amounts of orange juice to tuberculous guinea pigs on normal diets and found the survival period to be twice as long as that of tuberculous animals on a normal diet alone.

Similarly, Harde, Rothstein, and Ratish (6) found a very low rate of excretion of Vitamin C in pneumonia, which indicated an increased consumption of this vitamin in this disease. Vogl (18) applies this knowledge in his treatment of pneumonias by large doses of Vitamin C. As soon as pneumonia is diagnosed, the patient receives 200 mgm. of ascorbic acid subcutaneously, followed by daily doses of from 200 to 500 mgm., depending on the severity of the disease. Pulmonary abscess, chronic pneumonia, or carnification never occurred in cases treated in this manner.

In a study of 17 active cases of osteomyelitis (17 half-healed cases, 16 healed, and 10 controls) Abassy, Harris, and Hill (2) found a diminished rate of excretion of Vitamin C in the urine and a lowered response to test doses of Vitamin C,

indicative of an apparently increased usage of this vitamin during the infective process, greatest in the active cases, intermediate in the half-healed, and normal in the healed. Yavorsky, Almaden, and King (22) examined human tissues at autopsy for their Vitamin-C content, and noted that generalized infections were more common in those with a low Vitamin-C content. Woringer and Sala (21) reported scurvy in infants following diphtheria and pertussis.

These observations are most important in the conduct and care of any patient who will be subject to the many hazards of infection following any operation. As Lauber well said in relation to the hazards of ordinary life: "The main value of vitamins lies in prophylaxis, for only that organism which possesses an adequate amount of the vitamins is capable of defence and regeneration."

As to the mode of action of the vitamins in preventing and controlling infection, I believe it can be stated without hesitation that they are not specific in their action. One mode of action, presumably, is related to the justifiable assumption that the vitamins are necessary, in adequate amounts, for the proper functioning of the endocrine glands, and that when the latter are producing their proper secretions in sufficient amounts, the entire organism is better equipped to prevent infection and to promote healing.

As an example, we might cite the work of Scott (15) who showed that partially adrenalectomized animals withstood toxins and infection much less readily than the controls. Furthermore, it has been shown that the adrenal body and the pituitary body contain Vitamin C in more concentrated form than any known substance. The inference that these important endocrine bodies need an adequate supply of Vitamin C to function properly is logical. Interesting observations by Harris, Passmore, and Pagel (7) give credence to this view. They found that guinea pigs suffering from an acute infection with pasteurella pseudotuberculosis showed a considerable diminution in the amount of Vitamin C present in their suprarenal glands as compared with controls which had received the same amount of Vitamin C. The Vitamin C in the liver, on the other hand, was not significantly affected.

Another mode of action may be related to an observation by Manville and Grondahl (12) who found that the regeneration of red cells is possible only if yeast or some factor in yeast is included in the diet. Erythrogenesis in rats on a basal diet excluding the Vitamin-B-maturation factor stopped at the megaloblastic stage. Some factor in yeast was necessary to carry the megaloblast to the normoblastic stage. The importance of this observation in the restoration of the normal blood volume in the period immediately following severe blood loss at operation cannot be overestimated.

These considerations concerning the vitamins have led to certain precautions in the immediate pre-operative period (9). In operations of election, patients are placed on a high vitamin diet at home, or as in the case of the tuberculous patient, in the sanatorium for from one to two weeks before entering the hospital. In addition, during this period the important vitamins are prescribed in concentrated form: haliver oil, 2 capsules three times a day for Vitamins A and D; brewer's yeast powder, 1 heaping teaspoon in orange juice (or water, or milk, or coffee) three times a day for the various factors in the Vitamin-B complex; and the juice of at least four oranges and two lemons daily for Vitamin C.

When a patient is brought into the hospital for diagnosis or observation for a possible operation, the same dietary precautions are emphasized, as well as the ingestion of the concentrated vitamins. Operations are delayed whenever possible for at least three days of such preparation, and as soon as solid food is admissible after operation (usually on the third or fourth day), the same concentrated vitamins are administered to be available to the body tissues during the healing and convalescent periods.

In a study of the Vitamin-C content of human tissues Yavorsky *et al* (22) found a consistently diminished content in all tissues studied (adrenal, brain, pancreas, liver, spleen, kidney, lung, heart, and thymus) in those patients from forty-six to seventy-seven years of age as compared to the patients from one to forty-six years of age. This suggests that the older patients require a longer period of preparation by high vitamin intake than the younger patients.

For the emergency operation, little as yet can be done, although in a few instances, the purified Vitamins C and B have been administered hypodermically. It is to be hoped that these purified products, including Vitamins A and D, may soon be available at a reasonable cost for more extensive use in the preparation of patients for emergency procedures. It is probable, however, that such purification may eliminate some of the important factors, and dietary administration will remain for some time to come the preparation of choice.

A second pre-operative precaution relates to the hazard of exposure, unbeknown to patient or

surgeon, to the contagion of the common cold in the forty-eight or twenty-four hours preceding the operation. It is my belief that not infrequently patients are unwittingly exposed to such contagion immediately before entering the hospital. Signs and symptoms are not sufficient to show the early effects of such exposure and the operation is performed the day following admission. The "cold" meanwhile is developing and on the day following the operation gives the first evidence of its presence, at the moment of greatest weakness and susceptibility to further extension. To avoid the possibility of such a complication, one should attempt to have the patient enter the hospital at least three days before operation to permit observation under hospital care and to prevent contact with contagion carriers. It has been our practice to postpone all operative procedures in the presence of coryza, sinusitis, laryngitis, or acute bronchitis, and, as emphasized by Balfour and Gray (3), operation is delayed at least a week and frequently two weeks *after* the apparent recovery from an acute respiratory infection.

A third pre-operative precaution against the development of a postoperative pulmonary complication is the avoidance of too heavy sedation with the various morphine and barbital derivatives. The tendency these days is to attempt to put the patient almost to sleep, before the administration of the general anesthetic, by generous doses of nembutal or amytal reinforced with large doses of morphine and, on occasion, scopolamine. Extreme care is necessary in the dosage of such combinations, particularly since they are all respiratory depressants. As an example of overdosage an instructive case may be cited: a prominent professor of surgery prescribed the following pre-operative medication for a gastrectomy in a patient sixty-one years of age: pentobarbital, gr. 1½, at 8:45 p.m.; codeine sulfate, gr. 1, at 2 a.m. for pain; pentobarbital, gr. 3, at 6 a.m.; morphine, gr. ¼, scopolamine, gr. 1/100, at 7:15 a.m.; and cyclopropane was begun at 8:05 a.m. As a result, this aged, enfeebled woman was sound asleep and had an almost complete respiratory inhibition when the general anesthetic was begun, which increased immeasurably the difficulty of the administration of the gas anesthesia. On the introduction of an airway, the pulse dropped immediately from 104 to 68, which indicated an anoxemia incident to overmedication.

At the Stanford Clinic it is deemed safer to give the barbiturates the night preceding the operation and none the morning of operation, and to give a safe dose of morphine and, on occasion, scopolamine. Atropine is never to be given with scopolamine, and when given with morphine it should be given in small doses. Thick, sticky secretions are much more difficult to bring up, and as a consequence atelectasis is much more imminent. Nothing should interfere with the proper evacuation of the secretions during the anesthesia.

With regard to morphine and scopolamine, it is well to remember that these drugs produce their maximum effect approximately in one to one and one-half hours after administration. Ideally, this maximum benefit should occur at the beginning of the general anesthesia in order that it may be gradually eliminated in the course of the administration of the volatile anesthesia. In prescribing divided doses of morphine and scopolamine, it is unwise to give the second dose before the effect of the first has been determined. When divided doses are administered in the Stanford Clinic, the pre-operative medication is ordered by the anesthetist, who sees the patient one hour after the administration of the first dose. If the patient is drowsy no further medication is given. If he is alert, the second dose is administered.

In patients with chronic productive bronchitis or with productive pulmonary tuberculosis, overmedication is particularly harmful and should be carefully avoided. Furthermore, such patients are required, with the help of postural drainage, to expectorate their bronchial accumulations just before going under general anesthesia. Every effort is made to rid the bronchial tree of mucus and pus, and if it is at all abundant, the patient is operated upon in the Trendelenburg position with the head below the level of the thorax, to avoid the accumulation of bronchial secretions in the lung.

In all major operative procedures requiring general anesthesia, fluids by mouth and food are necessarily withheld during the night preceding operation for approximately twelve hours. A liver depleted of glycogen is notoriously susceptible to the injurious effects of chloroform. In lesser degree it is probably susceptible to all anesthetics. Accordingly, to counteract this period of starvation and deprivation of water, two precautions are taken: at nine o'clock on the night preceding operation 8 oz. of a high caloric fruit juice or 8 oz. of eggnog are administered; then, beginning two hours before the hour set for the operation, 1,000 c.cm. of 10 per cent glucose solution are slowly administered intravenously. These precautions are particularly helpful in the

thyrotoxic patient, and in the patient who is to undergo extensive gastric or bowel resections, or thoracic operations productive of shock. Subcutaneous infusions are administered as usual during the operation.

The anemic or bleeding patient is prepared with transfusions until the hemoglobin has risen preferably to 60 per cent, but one must occasionally be content with a hemoglobin of 40 per cent. Liver, iron, and concentrated vitamins, particularly Vitamin B, are stressed in the preoperative diet of the anemic patient.

In the presence of pyloric or intestinal obstruction, or vomiting just preceding operation, a Levine stomach tube is passed through the nose, the stomach washed with saline solution, and the tube left in place to permit ready escape of the gastric contents during operation. Such patients are also operated upon in a moderate Trendelenburg position.

Summarizing, we may say that the following pre-operative precautions are indicated to prevent postoperative pulmonary complications:

1) A high vitamin diet reinforced with vitamin concentrates for from five to ten days before operation. The giving of Vitamins C and B hypodermically before emergency procedures.

2) A high vitamin diet reinforced with vitamin concentrates as soon as feeding after operation permits.

3) Admission to the hospital at least three days before any operation to prevent exposure (unbeknown to patient or surgeon) to cold contagion in the twenty-four hours before operation.

4) Avoidance of overmedication with the barbiturates and morphine derivates, all of which are respiratory depressants.

5) In patients with chronic productive bronchitis, bronchiectasis, or intrapulmonary cavitation, the pulmonary tree should be emptied as completely as possible just before anesthesia.

6) Such patients should be operated upon in a moderate Trendelenburg position to avoid any accumulation of pus in the dependent portion of the lung during the operation.

7) In the presence of pyloric or intestinal obstruction, or repeated pre-operative vomiting, a small Levine tube should be passed, a gastric lavage performed with saline solution, and the tube left in place during the operation. The patients should be operated upon in a moderate Trendelenburg position.

8) To counteract the starvation and deprivation of water in the twelve hours preceding the operation, an intravenous infusion of 1,000 c.cm. of 10 per cent glucose solution is administered beginning two hours before the operation.

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THE OPERATIVE EFFORTS TO BE DIRECTED TOWARD THE PREVENTION OF PULMONARY COMPLICATIONS THROUGH THE EMBOLIC ROUTE

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PREVIOUS to the introduction of infiltration anesthesia[1] all postoperative pulmonary complications were thought to be due to the aspiration of, and the irritation which accompanied, inhalation anesthesia. When similar complications followed the use of cocaine (Gottstein, 1898; Mikulicz and Kausch, 1900; Gerulanos, 1900; Henle, 1901), a different conception of the mechanism giving rise to such complications was necessary and embolism from the field of operation was proposed. The differing opinion is still reflected in contributions to this important subject.

At the very base of this problem lies the primitive psychological reaction that the surgeon himself does not like to carry the blame for unfortunate sequelæ and naturally seeks an explanation other than of his own creation. It is easy and natural to uphold that an irritative substance which was inhaled should cause pulmonary difficulties. This reason completely disappears, however, when identical postoperative pulmonary disorders arise following the use of local anesthesia. In the face of this fact it is more remarkable that even our medical colleagues and even the anesthetists who are thus given some escape from criticism should continue to place the major blame on irritation and aspiration.

The fact remains that all of the types of postoperative pulmonary complications have occurred after local infiltration anesthesia. They occur in about the same percentages as after inhalation anesthesia. Major fatal pulmonary embolism has long been accepted, though frequently it is set aside as different from the other pulmonary complications. Pulmonary consolidation (pneumonia), pleurisy, abscess, and empyema have been thought by many to arise by way of differing mechanisms. Why? The patient was well before the surgical procedure; after the ordeal there is a serious complication; why suppose any other factors than those so obviously in the surgeon's wound are the source of this difficulty?

It is accepted that the mobility of the part (epigastric incisions carry the highest morbidity), the presence of sepsis, and the roughness of the surgeon contribute to the occurrence of these complications. We have repeatedly made studies in this field and have pointed out that embolism may be the mechanism resulting in the occurrence of such sequelæ. We have been able to substantiate this point of view experimentally. By liberating clots in the jugular vein of dogs we have shown that all of these pulmonary complications may be produced, the type of complication depending upon the size of the clot, whether it was infected or not, and if it was infected how great an immunity the animal had established to the infecting organism. Thus, a grossly infected clot in an animal with no immunity produces a rapidly spreading pneumonitis; a fragment of the same clot of the same size in a thoroughly immunized animal produces a temporary infarct, which may give the clinical signs of pleurisy if it reaches the periphery of the lung; and a fragment of the same clot of the same size in a partially immunized animal will produce a local lesion which will break down and result in an abscess. With this experience behind us it is natural that we should believe that the prevention of such complications lies in better treatment of the tissues in the wound by the surgeon.

We have repeatedly studied the percentage of complications in relation to the type of surgery and have convinced ourselves that the surgeon who was rough, who allowed desiccation of the tissues in the wound, and who took little care of hemostasis experienced a higher percentage of complications than his more gentle colleague who practiced a more meticulous technique. Let us consider for a moment the factors giving rise to thrombosis; these are slowing of the circulation time, and the presence of bacteria and injury in the intima. The speed of the circulation depends upon the cardiac effectiveness and may be improved by adequate pre-operative medications. The presence of bacteria unless new infections be introduced is beyond our control, but the injury to the intima is something the surgeon can influ-

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[1] V. K. Anrep introduced cocaine as an anesthetic in 1879. Carl Keller, of Vienna, first used it as a surgical adjuvant in eye operations in 1884, and J. L. Corning introduced its spinal use in 1885. Reclus in 1895 described its use as a local anesthetic in other fields, and Cushing's papers in 1898 and 1900 were among the first to recommend this method of anesthesia generally to surgeons.

ence. If the surgeon is rough, if he jams retractors against thin-walled veins, if he clamps vessels and does not ligate proximal to the part of the vessel that has been damaged, thrombosis is encouraged and desiccation hastens this process. Thus the technical performance of the operator relates directly to the later complications. The surgeon should be gentle, he should keep all exposed tissues moist, he must securely ligate vessels proximal to his clamp, and take care lest tissue juices enter open-mouthed veins. He should try to ligate tributary veins close to the major trunk with which they connect in order to avoid a stagnant pool of blood. As part and parcel of this meticulous technique he should take care not to strangulate large pieces of tissue, his suture material should be small, and every attempt should be made to have the wound free of débris and necrosing tissue. Bacteria enter every wound, but if there be a minimum of foreign material and no dead or dying tissue in the wound, the natural processes of the body will be sufficient to heal the wound without the appearance of sepsis. On the contrary, if such careful technique is not carried out, the wound will break down, simple thrombi will become infected thrombi, and these infected thrombi will easily become loosened and depart from the wound to lodge in the lung and produce a pulmonary complication. The type of complication in turn will depend on the size of the clot, whether it is infected, what part of the lung it lodges in, how much immunity the patient has for the type of bacteria in the clot, and also on the adequacy of the circulation. Because of the liberal anastomotic connections in the lung, an *infarct* is unlikely to be produced from the lodgment of a small embolus. However, if the circulation is inadequate, this does not hold true. *Abscess* is produced by the septic clot when there is a relatively high immunity to the organism in the clot, encouraging the formation of a walling-off process. If the immunity is low, the infection spreads and an area of *pneumonitis* (similar to *bronchopneumonia*) is produced. If the clot is large enough, fatal *pulmonary embolism* results.

The postoperative efforts in the face of embolic complications are obviously somewhat futile. However, an understanding of the mechanism by which the disorders have arisen gives us certain indications.

1. The circulation must be made as adequate as possible. It is better to digitalize individuals before rather than after the procedure, but rapid digitalization can be effected and is often of great assistance. Early motion plays a similar rôle and, though I have had no personal experience with its use and prefer digitalization, the institution of thyroid therapy has been shown to be beneficial through the same mechanism, i.e., speeding up the circulation.

2. The *adequate care of sepsis* is important. It will serve to prevent the further release of thrombi as tissues break down.

3. The adequate care of oral sepsis may be important. It has been shown that the agents which play a major rôle in the break-down of pulmonary tissue and the production of abscess of the lung are largely the anaerobes of the mouth, chiefly the fusiform bacteria and the spirochetes. These organisms are easily injured by arsenicals. In patients with "dirty" oral cavities, proved by smear preparations to contain the above organisms, it is often wise to institute intravenous arsphenamine therapy when local areas of pulmonary consolidation occur. This therapy will be efficacious only when the lesion is early and the organisms lie in tissue reached by the blood stream. If the organisms lie free in an already established abscess, the arsenical preparation obviously cannot reach them and no good results.

From this discussion it is obvious that in our opinion embolic lesions are due to what happens in the wounds of our patients. A decrease of the incidence of the embolic lesions will come only through an appreciation of the causes of thrombosis and embolism. Therapy after the occurrence of embolic lesions should be aimed at (1) restoration of an adequate circulation, (2) the adequate care of wound infection, and (3) the treatment of oral sepsis with arsenical drugs.

THE POSTOPERATIVE EFFORTS TO BE DIRECTED TOWARD THE PREVENTION OF PULMONARY COMPLICATIONS THROUGH THE BRONCHIAL ROUTE

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MY discussion concerns the period beginning when the surgeon has completed his last suture; the anesthetist is with the patient and the patient is still on the operating table. If inhalation anesthesia has been used, the surgeon can and should expect the patient to be awake or responsive to stimuli when the operation is finished. He can expect the air passages to be free of mucus and secretions. The patient must not be cyanotic and his skin must be warm and dry. These are the requirements of satisfactory inhalation anesthesia today. In the words of Henderson, "It is not many years since it was a matter of course that after every major operation the patient lay long unconscious, hypopneic and therefore cyanotic, then nauseated and tasting the incompletely exhaled anesthetic for hours. In part these conditions were due to acapnia induced by overbreathing and washing out of carbon dioxide under the influence of anesthetic excitement and moderate oxygen deficiency. In part they were due also to the acarbia-diminished blood alkali—that asphyxia and acapnia induce. Simultaneously the volume of the circulation was subnormal owing largely to the stagnation of the blood in atonic tissues. All of these features of depression are now largely avoided by the increasing skill of anesthetists in preventing both anoxia and acapnia" (10).

Inhalation anesthesia has been almost revolutionized by the judicious use of carbon dioxide. The anesthetist knows that carbon dioxide mixed with the anesthetic steadies and deepens respiration. It reduces the danger of respiratory failure and as the operation is being finished it ventilates the anesthetic out of the blood; it improves both the venous and the arterial circulation; it reduces postoperative vomiting; and it restores tone to the muscles, especially to the diaphragm and gastro-intestinal tract(11). Mild hyperventilation of the lungs with carbon dioxide at the close of an operation gives the patient a good start on the postoperative course. Recently attention has been directed to the low proportion of inert gases chiefly nitrogen, in the anesthetic mixtures commonly used. It has been pointed out that practically all the gases in the anesthetic bag are readily absorbable through the lung, and that collapse of the lung by absorption can take place during the operation. These readily absorbable gases consist of the anesthetic, oxygen, and carbon dioxide. It has been suggested that the high concentration of oxygen in the anesthetic bag can produce so-called oxygen poisoning and collapse of the lung tissue. Helium and hydrogen are inert gases. It is quite possible that these gases will find a useful place in the dilution of anesthetic mixtures in the future, but it is too early to make a statement concerning their value (4).

The patient is always entitled to start the postoperative course with the anesthetic well ventilated out of his system. The patient is entitled, also, to be awake and not nauseated. The patient is entitled to have the respiratory passages free of mucus and secretions. If he cannot rid himself of such secretions they should be removed by suction. If there is any gastric juice or secretion in the tracheobronchial tree, his head should be lowered and suction should be carried out through a catheter inserted into each bronchus. In no event should the air passages remain partially obstructed. The patient should not be chilled nor should he be overheated. Dry clothes should be placed on him.

The next consideration is the dressing of the wound. Two requirements are to be met. One concerns satisfactory splinting of the wound and the other concerns absence of interference with the respiratory movements. Obviously, the wound must be adequately supported. If it is not satisfactorily supported the patient will refuse to cough up secretions. At the same time, an abdominal dressing should not be applied over the lower part of the chest so that tidal exchange is not interrupted. Powers (19) has shown that tight abdominal binders and adhesive strapping play very little part in the reduction of the vital capacity after abdominal surgery, although Churchill and McNeil (6)

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reported a reduction of 30 per cent by the use of such dressings. Nothing should interfere with free respiratory movements. For this reason it is well not to give infusions into the subpectoral region. Dressings on the neck should always be loose. Surgical packs in the nose and throat should always be anchored to the outside, and I need scarcely mention that a tooth in a bronchus becomes a foreign body.

The next consideration is the position of the patient in bed. The factor determining the most desirable position is whether the patient has or has not a good cough reflex. The ability to produce a good lusty cough is always desirable and never undesirable. It is never desirable to destroy the ability to cough up secretions by prolonged deep anesthesia or by pre-operative or postoperative drugs. As a rule the patient goes into slumber after the operation is over and during this period of relaxation, regurgitated gastric juice and secretions might enter the trachea without calling forth violent coughing. There is no disagreement to the statement that these secretions in the lung bring about postoperative pulmonary complications (21, 14, 17). In special instances it is desirable to keep the stomach empty, even with the stomach tube if necessary (1). Fluids should not be given by mouth too early because of the possibility of regurgitation and entrance into the trachea. During the period of postanesthetic slumber the position should be such that gravity will carry these secretions out of the mouth.

The head of the patient should be about a foot lower than his feet and should be turned so that the mouth touches the sheet. The most comfortable and the best position is on the side with the opposite knee flexed, a pillow behind the back and one between the knees, and the head turned toward the bed. Gray (8) reports a reduction of 30 per cent in the incidence of postoperative pulmonary complications by the use of the Trendelenburg position for the first twenty-four hours after operation. After the postoperative slumber has passed off and the patient is sufficiently responsive to cough satisfactorily, the position in bed should be that which affords the greatest freedom for respiration and for coughing. This is the semi-Fowler position with an elevation of from 20 to 40 degrees. In this position the diaphragms occupy a lower level and breathing is easier and deeper (12). Christie and Beams (5) demonstrated a reduction of 5.5 per cent in the vital capacity with the patient in the recumbent position. In this connection it might be mentioned that abdominal distention is to be properly controlled. The patient should be encouraged to take deep breaths. He should not be kept in any one position because it has been shown that position is an important factor in collapse (15, 16, 7). Scott and Joelson (20) have shown that the side that is down is the side where collapse develops. It is advisable to turn the patient every two hours, and the changes in position should begin early in the postoperative period. If there is any secretion in the tracheobronchial tree the patient should be urged to cough it up even if it hurts. We can support the wound with the hand if it helps, but the secretions must be brought up. If secretions are present and cannot be coughed up, they should be removed by suction through an intratracheal catheter (9). Bronchoscopic drainage might be indicated, but this is scarcely to be recommended for a patient who is critically ill (13).

It can be mentioned here that drugs should be used with discretion. The cough reflex should not be sacrificed by excessive use of morphine or other drugs. They make the respiratory movements shallow (18). According to Brill and Leake (3), atropine makes the secretions more tenacious and tends to shift the intrapleural pressure toward the positive side. The use of potassium iodide and ammonium chloride to liquefy tenacious secretions so that they can be coughed up has been recommended by Mathes and Holman (18). In this regard steam inhalations might be useful.

The next consideration is the value of hyperventilation of the lungs with carbon dioxide as a means of preventing postoperative pulmonary complications. Hyperventilation can be effected by having the patient rebreathe his own exhaled air or by breathing 5 per cent carbon dioxide mixed with oxygen through a mask. The exercises are usually given from three to five times daily for the first three days after operation. These exercises can become forceful and should not be carried to the point of undue fatigue. They do two things. They make the patient breathe deeply so that the lungs are well inflated. They also make him cough, and frequently assist in raising secretions.

Hyperventilation of the lungs by inhalation of carbon dioxide following operation has been widely used. The results are widely divergent. It has been recommended by Asa, Balfour, Beigh, Blond, Brill, Brown of New Zealand, Brunn, Brock, Carlson, Coryllos, Cutler, Fischer of Germany, Freeman of Ireland, Fuller, Graham, Gray, Gunther, Haight, Henderson, Hinshaw, Judd, Lindskog, Lubin, Lundy, Moore,

Overholt, Powers, Shatzky, Synder, Tondeur of France, Turnbull of New Zealand, Waldron, and Watter.

Hyperventilation of the lungs is of no value in the reduction of the incidence of postoperative pulmonary complications according to Beecher, Bogan, Briscoe, Dowling, King, Mason, Reimann, Ryan, and Sise. The problem has been studied from the standpoint of pulmonary physiology. It has been shown that definite alterations take place after laparotomy. According to Beecher (2), these alterations are severe and consist of a marked reduction of the tidal air; an increase in the respiration rate; a rapid, shallow type of respiration, a marked reduction of complemental air and also of supplemental air; a crippling of both forced inspiration and expiration; a marked reduction of the vital capacity; and a marked decrease of the subtidal lung volume and the maximum lung volume. According to Beecher's study, these alterations in pulmonary physiology after laparotomy were the same whether hyperventilation with carbon-dioxide inhalation was used or not. On the other hand, Powers (19) has shown that the reduction of the vital capacity is less severe after operation when hyperventilation is used.

Having reviewed the literature on the subject, it is my conclusion that hyperventilation of the lungs by the use of carbon-dioxide inhalation after operation should be continued as a routine measure. This conclusion is soundly conceived if one accepts pulmonary hypoventilation as the fundamental mechanism in the production of these complications. Hyperventilation also assists in clearing the air passages by making the patient cough. At the same time, we must conclude that its value, as a prophylactic measure, has not been established definitely on a statistical basis.

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Closing Remarks by Dr. Holman

In addition to the points already covered, I should like to stress the great importance in the postoperative period of frequent change of position immediately after the return of the patient to his bed. It is routine on my service to order a 90 degree change of position every hour for the first three days, following which the patient is instructed to move freely about in bed at least every hour and to flex and extend his knees and thighs at very frequent intervals. Such activity undoubtedly increases the rate of circulation, prevents the stagnation of blood in restricted areas, and improves the respiratory exchange by the prevention of stagnation and accumulation of secretions in limited areas of the bronchial tree. Moreover, such changes of position are the best guarantee against the accumulation of fluid and gas in restricted portions of the gastro-intestinal tract, and thus prevent acute dilatation of the stomach and intestinal distention.

In addition, immediately after operation the patient is made to take six or eight deep breaths every half hour, an exercise that we believe does as much good as the carbon-dioxide inhalations, except under very special conditions.

I wish to express my sincere thanks to Drs. Cutler and Beck for their instructive contributions to this discussion.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Berens, C., and Bogart, D. W.: Certain Postoperative Complications of Cataract Operations: with Especial Reference to a Study of 1,004 Operations. *Am. J. Surg.*, 1938, 42: 39.

Complications following cataract operations are serious principally because they may result in partial or complete loss of visual acuity. For the purpose of studying the causes of these complications, and comparing the results of intracapsular and extracapsular extraction in the hands of the average surgeon, the records of cataract operations performed at the New York Eye and Ear Infirmary during the past two years were examined.

Of the total of 1,004 clinic patients operated upon for cataract by staff or house surgeons, 70 per cent had extracapsular and 30 per cent intracapsular extractions. Seventeen per cent of the extracapsular operations were attempted intracapsular operations.

The most frequent postoperative complications were: hemorrhage into the anterior chamber, which occurred in 4 per cent of the intracapsular and 1.4 per cent of the extracapsular extractions, and loss of vitreous, in 9.9 per cent of the intracapsular and 9.0 per cent of the extracapsular extractions. Other complications occurred in only a few cases in each series.

Preliminary examination of the patient should be complete, which will eliminate many of the causes of postoperative complications, and should include a careful search for foci of infection. If foci are found they should be removed, or the resistance of the patient to them should be raised. A study of the psychology of the patient will help prevent mental disturbances after operation, as well as his sitting up in bed the same day and his getting out of bed the day after operation. Elderly patients should be watched carefully from the first forty-eight to seventy-two hours, and should have a hole cut in Ring's mask at the first dressing. A pre-operative trial of sedatives prevents disturbance due to idiosyncrasy. Mild sedation for several days before the operation is of value. General conditions, such as diabetes, high blood pressure, and syphilis should be controlled before operation. If one eye has been operated upon previously the patient's sensitivity to lens antigen and uveal pigment should be studied, especially if postoperative inflammation had developed.

The pre-operative instillation of 1 per cent silver nitrate and argyrol helps to prevent postoperative infections. Adequate anesthesia and akinesia should be used, and these should include the retrobulbar injection of procaine and adrenalin. A sufficiently large section of the cornea, care in using the instruments, and the use of half-normal saline solution warmed to body temperature help prevent striate opacity of the cornea. The incision should be made so as to obtain a complete conjunctival flap. Care should be used to avoid dislocation of the lens. Removal of all retained cortex should be assured by the use of the ultraviolet lamp. The wound should be completely closed by sutures as soon as the lens presents, and the lips of the conjunctival wound should be pinched together.

The patient should not be permitted to strain or cough after operation. Strong miotics should be avoided after primary instillation, unless prolapse of the iris occurs. Observation of the upper border of the wound or touching of the upper eyelid should be avoided.

The treatment of postoperative complications is summarized as follows:

Abrasion of the cornea and a tendency of the iris or vitreous to prolapse require a firm dressing. Hot applications and dionine are used for striate keratitis. Delayed wound closure calls for the preparation of a conjunctival flap, iridectomy, excision of vitreous, or clearing of the wound in other ways. Trichloracetic acid may be applied for cystoid scars or for small beads of prolapsed iris (electrocoagulation has been reported of value). For extensive prolapse of the iris not covered by conjunctiva, a small iridectomy may be performed and the wound closed with sutures. If the prolapse is extreme a flap may be made by dissection upward from the cornea.

Repeated hemorrhages can be controlled by intravenous calcium gluconate, normal horse serum, snake venom, and brain extract given intravenously.

For detachment of the choroid, sedatives, elevation of the head, and measures to increase the coagulating power of the blood are indicated. Detachment of the choroid is thought by some to occur much more frequently than has been estimated. In one case an almost complete detachment was observed, but there remained no trace of the condition ten days after operation.

Detachment of the retina is not necessarily a complication of the operation, but may be caused by anterior choroiditis of tubercular or infectious origin. Myopia and loss of vitreous were important factors in 30 cases reported by Shapland. Woodruff reported cures in only 18 per cent after operation. Cruise reported success with the Safar operation. The Gonin method resulted in complete reattachment in one of the cases seen by the authors, in which the subretinal fluid was aspirated. A final acuity of 20/30 resulted.

Hypertension caused by iridocyclitis may respond to aspiration of the anterior chamber or paracentesis and mydriatics. For persistent hypertension, iridocorneosclerectomy after simple extraction may be done. If an iridectomy has been performed, corneosclerectomy over one pillar may be combined with iridencleisis.

Postoperative non-suppurative inflammation requires search for and treatment of chronic infections.

Iritis caused by retained protein in the anterior chamber requires atropine, infra-red rays, autohemic injections and typhoid vaccines, or other foreign proteins. Endophthalmitis phaco-allergica requires desensitization to lens allergen before and after operation. Injections of uveal pigment should be used if sensitiveness develops coincidently with postoperative inflammation.

Smears and cultures indicate the treatment of choice in suppurative infections. Pneumococcus serum should be used if indicated. Other measures are irrigation of the anterior chamber with 1:4,000 hexylresorcinol solution, intravenous typhoid vaccine, or typhoid "H" antigen.

When expulsive hemorrhage occurs, sedatives, sutures, scleral puncture, and lightly compressing dressings are necessary.

Aside from the necessary careful technique at operation, one of the most important factors in avoiding complications is the use of care in making postoperative dressings, especially the avoidance of pressure by unnecessary or clumsy manipulation.

It is possible to avoid entirely or to render comparatively harmless many of the complications which often result in a greater or lesser degree of blindness.

The number of immediate and postoperative complications was approximately the same in both the extracapsular and the intracapsular groups, which indicated that as done at this institution the intracapsular operation is a valuable and fairly safe procedure in the hands of the average surgeon.

EDWARD S. PLATT, M.D.

NOSE AND SINUSES

Semenov, H.: The Surgical Pathology of Nasal Sinusitis. *J. Am. M. Ass.*, 1938, 111: 2189.

The author states that the microscopic changes of the sinus mucoperiosteum in several hundred surgical specimens showed that thickening in excess of 2 mm. was associated with deep-seated degenerative changes in 50 per cent of the cases.

Purulent sinusitis constituted 72 per cent of the cases and non-purulent hyperplastic polypoid and cystic degeneration constituted 28 per cent.

Degeneration of the mucous membrane of the sinuses may be explained in part by the rudimentary microscopic structure of the stroma. A preponderance of loose areolar tissue favors the formation of mesothelial cysts and polypoid degeneration. Membranes of the sinuses endowed with a more fibrous periosteal type of stroma are resistant to the same pathological processes. The healing power in such a membrane is shown in the case described as it appeared after twenty-five years of mucopurulent sinusitis.

Manifest allergic sinusitis occurred in 17 per cent. Non-allergic inflammation of the sinuses as determined by a careful history and examination of the patient and histological preparations appeared in 47.6 per cent of the cases.

The allergic membrane is prone to infection and resistant to treatment. The degenerative changes were greater in the allergic sinuses. Hyperplastic sinusitis, especially the bilateral type, was allergic in 70 per cent of the non-purulent cases.

Tissue cultures revealed a preponderance of streptococci and staphylococci in chronic sinusitis, mixed infection being present in 80 per cent.

Exudative sinusitis usually responds to conservative treatment. Degenerative changes which are irreversible in character require treatment of a radical type.

Postoperative healing in the paranasal cavities is accomplished by the formation of a dense layer of white fibrous connective tissue which epithelizes by an ingrowth of nasal mucosa.

JAMES C. BRASWELL, M.D.

NECK

Daniélopolu, D., and Others: The Classification and Pathogenesis of Endemic and Sporadic Thyroidism (Classification et pathogénie des thyroïdies endémiques et sporadiques). *Presse méd.*, Par., 1938, 46: 1363.

For this study 38,657 medical observations were made in Roumania. The authors have separated the normal from the pathological physiology of the thyroid and propose a new classification of these affections, believing that the thyroid, in addition to its morphogenic and metabolic functions, possesses also a vegetative function.

Thyroidism is defined and the physiologicopathological classification of thyroid conditions is as follows: (1) normal thyroidism, (2) hyperthyroidism, (3) hypothyroidism, and (4) paragoiterous affections.

The geographical distribution of thyroid disease showed that in the villages where the economic situation was very bad, endemic thyroidism was found. In the towns of the same region where the economic situation was much better, the endemic thyroidism was less pronounced. The authors know of a region in which for forty years endemic thyroidism was very common and in which this condition has diminished following the institution of methods of communication and the establishment of the petroleum industry, which has raised the standard of living.

One must live many months in a region before endemic thyroidism will develop. The inhabitants who left the region for several years found that their goiter diminished or even disappeared. In one region

19 inhabitants left their community (11 boys and 8 girls) to pursue their studies in higher schools in other localities. They ordinarily left at about the age of eleven years and returned to the community from nine to eleven years later. When examined upon their return no goiter was found except in 2 girls, in whom the goiter was very small; these girls had been absent from the villages approximately from four to six years.

Superficial water was found to induce thyroid disturbances, and when water was taken from a greater depth in the same localities it did not have these properties. Although iodine deficiency cannot be considered a determining factor, there is nevertheless a predisposition to goiter when such a deficiency exists.

Females are more frequently afflicted with endemic thyroidism than males; pregnancy aggravates the condition. Endemic thyroidism may be congenital, but usually commences early in life, developing most commonly at puberty.

Without doubt heredity plays a rôle in endemic thyroidism and definitely favors cretinism. Histories of a very large number of families with thyroid disturbances in endemic regions show that individuals living under the same conditions, nourished in the same manner, and exposed to the same determining factors may develop either the simple goiter, the hyperthyroid, or the hypothyroid type.

Sporadic thyroidism is rarely found in families with thyroid affections and is due to variable causes such as intoxications, infections, and nervous factors. The factors responsible for sporadic thyroidism have most commonly been typhoid fever, pneumonia, and postpuerperal infections. Basedow's disease has been found to develop following emotional stress. Iodine deficiency provokes a hyperplastic thyroidism.

The factor which produces thyroid disturbances acts also upon the anterior lobe of the hypophysis. Thyroidism which is caused by a nervous factor is produced by the action of the nerve centers on the hypophysis with the resultant hyperproduction of hypophyseal thyreostimulant.

RICHARD J. BENNETT, JR., M.D.

Curtis, G. M., and Puppel, I. D.: The Iodine Metabolism in Exophthalmic Goiter. *Ann. Surg.*, 1938, 108: 574.

The blood iodine in untreated exophthalmic goiter is usually increased. Curtis found an average of 26 micrograms per cent in the blood of 11 patients with exophthalmic goiter, as compared to an average normal of 12, but there was no direct correlation between the level of the basal metabolic rate and the concentration of the blood iodine. Thus, a patient with a basal metabolic rate of +18 per cent had a blood iodine of 30 micrograms, while one with a basal metabolic rate of +95 per cent had a blood iodine of 13 micrograms per cent. By the use of a new technique, the normal blood level was found to be only 4 micrograms per cent. The iodine in the urine, feces, and sweat was determined in 10 patients, 5 of whom had an elevated basal metabolic rate. All 10 had a negative iodine balance, those with hyperthyroidism losing about four times the amount ingested. This negative iodine balance is compared to the negative calcium balance in hyperparathyroidism.

PAUL STARR, M.D.

Naffziger, H. C.: Progressive Exophthalmos Associated with Disorders of the Thyroid Gland. *Ann. Surg.*, 1938, 108: 529.

Clinical records indicate that exophthalmos occurs in 50 per cent of patients who have exophthalmic goiter, although the clinical evaluation of the degree of the exophthalmos is almost useless. In one-half of the cases the exophthalmos disappears after operation; in another 20 per cent, it decreases: in a few patients there is progression of the condition in varying degree, but in only a very small number does it progress to a dangerous degree.

Operations on the sympathetic nerves result in a variance in the size of the lid fissure and pupils, but the position of the globe in the orbit remains unchanged.

The author's operation was performed in the cases of 31 patients, including 8 personal cases. The results were unsatisfactory in 4 patients and there were 2 deaths.

In the author's series of 8 cases, the ages of the patients (4 women and 4 men) ranged from twenty-eight to fifty-three years. All of the patients had operations for typical exophthalmic goiter. Progression of the exophthalmos was noticed within two months following the operation; the basal metabolic rate varied from normal to minus 32; the eyelids became puffy, the conjunctiva edematous, and the eye movements limited. Corneal ulceration appeared later. Vision varied according to the condition of the cornea and the optic nerve. Retrobulbar resistance was definite. Immediately after operation, improvement was noted.

In every case, the orbit was tightly packed with extrabulbar muscles, and the volume was five to ten times that of normal. The color was pale, and microscopic examination showed the presence of a Zenker-like degeneration. There was a fraying of the muscle fiber which stained for collagen. Interstitial edema was definite. Round-cell infiltration was present, particularly perivascularly, apparently in response to the muscle necrosis. Biopsies from other muscles failed to show such changes, although they have been reported in the literature.

Some cases which show no evidence of thyrotoxicosis may show exophthalmos due to a myopathy, rather than a demonstrable neurological disorder. Naffziger was able to produce proptosis by the injection of the thyrotropic hormone of the pituitary gland. Marine and Rosen believe that exophthalmos is produced by this hormone and that its development is inhibited, at least partially, by gonadectomy and prevented by thyroxin.

FRED S. MODERN, M.D.

Frazier, W. D., and Ravdin, I. S.: The Use of Vitamin B_1 in the Pre-Operative Preparation of the Hyperthyroid Patient. *Surgery*, 1938, 4: 680.

The observation of hyperthyroid patients with satisfactory reduction of the metabolic and pulse rates, but who continue to have anorexia and weight loss after iodine therapy, and others who have loss of weight out of proportion to the increase in the basal metabolic rate and appetite level, suggests that although the caloric intake of these patients may be sufficient, absorption or utilization of the ingested foodstuffs may be below the normal.

If the metabolic rate is raised by disease or the administration of thyroxin, Vitamin B_1 must be added to the diet to prevent the appearance of the symptoms of a B_1 deficiency which may develop rapidly. As the capacity for storage of this vitamin in human tissues is limited, the maintenance of the Vitamin-B_1 stores in the tissues is dependent on an adequate intake in the diet.

Although most hyperthyroid patients have increased appetite at the onset of the disease, the majority develop anorexia if the thyrotoxic symptoms are maintained. Hinwich, Goldfarb, and Cowgill have shown that anorexia develops much more rapidly in dogs fed thyroxin and a diet deficient in Vitamin B_1, than in those getting a normal diet plus thyroxin. They suggested that a B_1 deficiency may be the important factor in the anorexia and weight loss of hyperthyroid patients.

Sure and his associates found that by means of a highly concentrated Vitamin B_1 extract they were able to reduce the injurious effect of thyroxin in the rat. Later they were able to protect these animals entirely from the toxic influence of thyroxin by the parenteral administration of very large amounts of crystalline Vitamin B_1. Recently they have reported that Vitamin B_1 is more effective if the other components of the B complex are added. Other authors have demonstrated that the administration of additional carbohydrate to the diet of various animals markedly increases their requirement for the B_1 fraction. If this requirement is not met, hyperglycemia and depletion of liver and muscle glycogen result. If Vitamin B_1 is then supplied in adequate amounts the blood sugar falls and glycogen storage in the liver is increased. It is well known that thyrotoxicosis is commonly associated with disturbance of the carbohydrate metabolism. These changes are characterized by hyperglycemia, decreased glucose tolerance, and depletion of the liver glycogen. The similarity between these changes and those attributed to B_1 deficiency is noteworthy. It is now generally agreed that the administration of an abundant supply of readily assimilable carbohydrate is an important step in the treatment of severe grades of thyrotoxicosis. If thyrotoxic patients are deficient in Vitamin B_1 it seems equally important that this factor be supplied during the period that the carbohydrate intake is being increased.

To study the importance of the B complex a control group of 28 patients were given a high carbohydrate diet without Vitamin B_1, in addition to the usual therapeutic measures, while another group of 50 patients were treated in a similar manner but received hypodermically 10 mgm. of crystalline Vitamin B_1 every other day and 10 mgm. of Brewer's yeast daily by mouth. There are three respects in which the group given Vitamin B_1 showed improvement over the control series: by the degree of reduction of the pulse rate, the number of patients who gained weight and whose appetite increased, and the length of time required for adequate pre-operative preparation. The improvement noted in the series treated with the Vitamin was most marked in the more toxic group, in whom avitaminosis is most likely to develop. These findings are in agreement with the known effect of Vitamin B_1 on the cardiovascular and gastro-intestinal symptoms of Vitamin-B deficiency. HAROLD C. OCHSNER, M.D.

Smith, M. K.: The Amount of Thyroid Tissue to be Left in Operations for Diffuse Toxic Goiter. *Ann. Surg.*, 1938, 108: 563.

In a series of 75 patients with diffuse toxic goiter, the weight of the remnant of thyroid after thyroidectomy was indirectly estimated by weighing a similar piece of the specimen removed. It was thus found that in 65 patients, among whom there were no recurrences, the remnant had weighed about 7 gm. or less, and that in 10 patients, in whom persistence of the elevated metabolism had occurred postoperatively, the remnants averaged 10½ gm. The author, therefore, advises that the surgeon leave a remnant weighing 6 gm. This corresponds to a piece measuring 3 by 1 by 1 centimeters on each side.

PAUL STARR, M.D.

Lahey, F. H., and Hoover, W. B.: Injuries to the Recurrent Laryngeal Nerve in Thyroid Operations. *Ann. Surg.*, 1938, 108: 545.

The recurrent laryngeal nerve was injured in 1½ per cent of Lahey's cases and in 3 per cent of other writers' cases. Lahey exposes routinely the recurrent laryngeal nerve in the course of thyroidectomies, and proves that it can be seen and palpated against the trachea, and that its moderate stretching causes no paralysis; moreover, that it can be satisfactorily sutured, if severed.

In the usual course of severance of the recurrent laryngeal nerve, there is no immediate respiratory difficulty if both nerves are cut, but the patient is unable to talk following the operation. In six months the ability to talk improves but dyspnea becomes increasingly severe on even moderate exertion. Inspiratory crowing and roaring during sleep are other symptoms.

The most frequent site of injury is at that point where the nerve becomes intralaryngeal (Fig. 2). It is rare at the level of the inferior thyroid artery (Fig. 1).

One of the frequent reasons for bleeding is the tearing off of the upper branch of the inferior thyroid artery close to the trachea, when it retracts

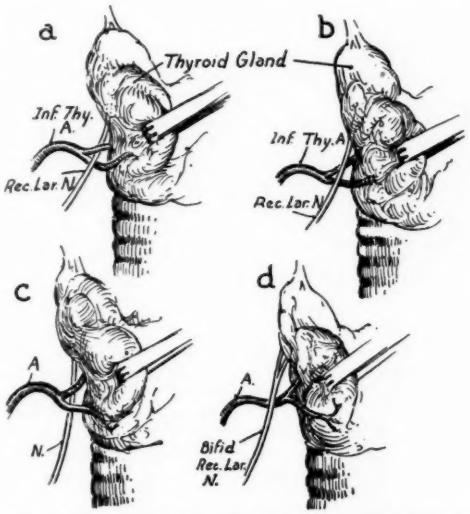

Fig. 1. Variations in the relationship between the recurrent laryngeal nerve and the inferior thyroid artery encountered in operations on the thyroid. (a) An uncommon relationship: the nerve passing over one branch of the inferior thyroid artery and under the other. (b) Not the rule, but a not uncommon relationship: the nerve passing entirely anterior to the artery. (c) By far the most common relationship: the nerve passing entirely posterior to the artery. (d) A not uncommon division of the nerve before entering the larynx. (Courtesy of J. B. Lippincott Co.)

behind the thyroid stump. The nerve lies very close to the bleeding point. If, however, the trunk of the inferior thyroid artery is ligated, instead of the point of bleeding, the nerve lies at a sufficient distance to be safe. This is a valuable point.

The severed recurrent laryngeal nerve should be reunited within three months after the injury. During the search for the nerve stumps, the thyroid remnants should be completely isolated from the internal jugular vein and common carotid artery. Then the thyroid remnant is rotated inward and the inferior thyroid artery identified. A Berens' magnifying loupe aids in the identification of the nerve. The upper end can usually be found where the lower horns of the thyroid cartilage are in contact with the cricoid. At present there is no way in which one can be sure of how to unite adductor with adductor, and abductor with abductor fibers. The nerve is a little flat and the sutures should be on the inner and outer margins. If the slack between the nerves is slight, occasionally it can be increased by cutting of the inferior thyroid artery. If a nerve graft has to be done, the technique of Duell and Ballance or a foreign nerve graft is recommended.

A rare abnormality is the non-descent of the recurrent laryngeal nerve, in which instance it may be injured at the upper thyroid pole.

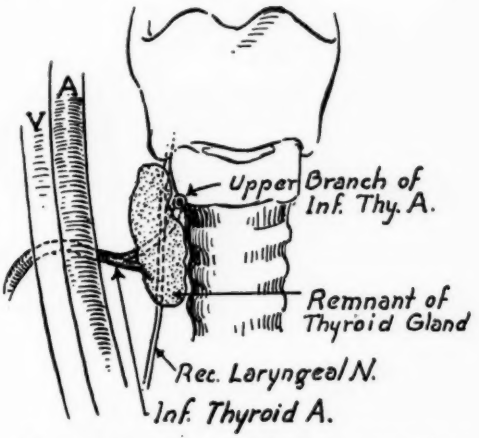

Fig. 2. Showing the relationship of the recurrent laryngeal nerve, before it enters the larynx, to the upper branch of the inferior thyroid artery. This is depicted diagrammatically as seen from above as it is in a subtotal thyroidectomy. Attempts to snap this bleeding branch in its position between the thyroid and the trachea can result in injury to the recurrent nerve.

The arrow points to the trunk of the inferior thyroid artery, at which point it should be ligated for bleeding of the upper branch of the inferior thyroid artery, rather than an attempt being made at ligature of the bleeding vessel itself.

Large intrathoracic goiters cause a safe displacement of the nerve and rarely lead to injury.

If both recurrent laryngeal nerves are permanently injured, the patient may have comfort and ability to speak through a tracheotomy tube fitted with a Tucker valve. If he objects to the tube and is content to speak permanently with a hoarse voice, then the submucous resection of the vocal cords may become necessary. This gives ample air space and the operation was successful in 75 per cent of the cases. FRED S. MODERN, M.D.

Richards, L.: Types of Laryngeal Obstruction and Their Treatment. *Am. J. Surg.*, 1938, 42: 239.

The author states that the cardinal signs of laryngeal obstruction are an increasing respiratory and pulse rate, stridor, indrawing of the supraclavicular, suprasternal, and epigastric spaces, restlessness, and pallor or cyanosis.

Acute inflammatory disease, new growths (benign or malignant), muscular spasm or paralysis, external pressure, and the presence of foreign bodies account for the majority of cases of acute laryngeal obstruction.

Healed inflammatory disease and faulty tracheotomy are the causes of most cases of chronic laryngeal obstruction.

Severe acute laryngeal obstruction demands prompt and adequate relief either by intubation or

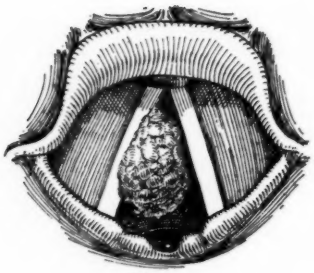

Fig. 1.

tracheotomy. Chronic stenosis requires either dilatation or plastic reconstruction. (Courtesy of Am. J. Surg.) JAMES C. BRASWELL, M.D.

Freedman, A. O.: Diseases of the Ventricle of Morgagni, with Special Reference to Pyocele of a Congenital Air Sac of the Ventricle. *Arch. Otolaryngol.*, 1938, 28: 329.

Laryngologists regarded the ventricle of the larynx as merely a slit between the true and false vocal cords before this space was more fully described by Morgagni. Hilton made a thorough study of this ventricle, noting its anterior upward extension to form the anterior vertical blind pouch, which is known as the sacculus ventriculi laryngis. Negus proved conclusively that the function of the larynx is not primarily that of phonation, but that of an inlet valve for the purpose of respiration. He traced the development of the larynx phylogenetically, and demonstrated modifications which took place in this organ in the various species, in order to adapt it to the requirements of each. The sacculus in man is considered the vestigial homologue of the ventricular air sac of the higher apes.

A study of the normal structure of the larynx is important in the study of the origin and location of the various pathological conditions that may occur. Normally, the true cord, the free margins of the ventricular band, and the posterior surface of the epiglottis are covered with stratified squamous epithelium. The rest of the larynx, the ventricle of Morgagni, and the sacculus are covered with stratified columnar epithelium. The stroma contains lymphoid cells scattered singly and in islands. Many tubular glands lined with mucous and serous cells appear in the submucosa of the ventricle and sacculus, and empty their contents into the ventricle. The glands are imbedded in fat surrounded by the thin muscle fasciculi of the thyroepiglotticus and aryepiglotticus muscles. In the region of the true vocal cords there are practically no glands and the entire submucosa consists of muscle.

Because of the abundance of mucous and serous glands surrounding and discharging into the sacculus and ventricle, it has been suggested that physiologically the sacculus may be considered the oil can of the vocal cords. Since the ventricle and sacculus are blind, stagnant recesses, surrounded by a mucosa which is rich in mucous glands and lymphoid tissue, it is probable that cancer, tuberculosis, and benign papilloma occur more frequently in these areas than has hitherto been supposed. Thus, the laryngoscopic picture of these conditions may be regarded as the end-result of a "spill over" from the ventricle to the neighboring structures.

The author reports a case of pyocele of a congenital air sac of the ventricle—an extremely rare condition. The patient had a tumor mass spreading over the anterior half of the left ventricle and ventricular band. The condition was diagnosed as carcinoma of the larynx. After further study the diagnosis was that of pyocele of a congenital air sac of the larynx, associated with secondary inflammatory changes of the true and false vocal cords and the ventricle and simulating carcinoma. The history of this rare and puzzling condition was as follows:

The patient had a congenital atavistic laryngeal air sac like that found in the anthropoid ape. In some way it became infected through its opening into the ventricle. It became filled with pus, which constantly "leaked" over the anterior part of the cord, the ventricle, and the ventricular band, and a chronic inflammation developed with granulation tissue about the parts involved. This granulation tissue, in turn, dammed back the secretion in the sac in a valve-like manner at its point of exit in the ventricle.

The author described another rare case of prolapse of the sacculus of the ventricle of the larynx, which occurred as a result of some pathological condition in the neighborhood of the normal sacculus. "Prolapse of the ventricle" is a term used to indicate the protrusion of a portion of the ventricular mucosa as the result of inflammatory edema or hyperplasia, so that parts of the ventricle which are normally out of sight are carried inward along the swelling and come into view through the laryngoscope. In this case the original clinical diagnosis was that of cyst of the larynx. Not until the pathological report was carefully co-ordinated with the clinical and operative findings was the correct diagnosis made.

A third case described was a laryngocele, a comparatively rare condition, occurring in an infant. When the child was quiet nothing unusual was noticeable; when it cried, a sausage-like swelling appeared on the right side of the neck, starting from the region of the thyroid cartilage and extending obliquely upward and outward to the right angle of the mandible. This swelling was "airy" to touch and tympanitic in percussion. The condition was a probable morphological reversion to the condition existing in the higher apes, with a persistent air sac communicating with the ventricle.

MATHIAS J. SEIFERT, M.D.

Orton, H. B.: Cancer of the Laryngopharynx. *Arch. Otolaryngol.*, 1938, 28: 344.

Malignant tumor is frequently found in the small area extending from the tip of the epiglottis to the

opening in the esophagus. Malignancy of the laryngopharynx is extrinsic cancer of the larynx. In this category belong growths in the epiglottis, the aryepiglottic folds, the lateral and the posterior pharyngeal wall, the piriform sinus, and the postcricoid region.

Most lesions in these sites show a surprising degree of advancement before diagnosis is made because of the slow growth of the cancer and the insufficiency of early symptoms. Cancer in the laryngopharynx is not rare. Its manifestations are so common that frequently they are neglected, and diagnosis often is not made until the tumor has made considerable progress.

The usual ages of patients with this type of cancer are between forty and sixty years. The epilaryngeal type of growth is more common in men than in women, whereas the hypopharyngeal type of growth is almost entirely limited to women.

The author has found a close relationship to carious teeth in a large majority of these malignant tumors, which often cause slight enlargement of the cervical glands. Any patient in the age period which is most susceptible to cancer, showing enlargement of the cervical glands, no matter how slight, should be suspected of having cancer until it is proved otherwise. The author points out that any abnormal sensation in this area, which is known to have been present over a period of time, should be regarded seriously. When pain is present, it is usually intermittent. Cancer of the laryngopharynx is usually of the squamous-cell type.

Symptoms generally depend on the site of the lesion. At the beginning there may be some abnormality, such as a tickling sensation, a constant clearing of the throat, or the sensation of a foreign substance which cannot be dislodged. Increased salivation and mucus in the piriform sinus that cannot be emptied by swallowing, are further significant symptoms. Among the later symptoms are alteration of voice, accompanied by choking at or between meals, due to anesthesia or analgesia of the posterior branch of the inferior laryngeal nerve. A late, and too often inoperable, picture presents loss of appetite, difficulty in swallowing, and enlarged, fixed cervical glands.

Gland involvement occurs early. The course is fairly rapid, and if prompt treatment is not undertaken the patient has but a short time to live. A thorough examination will accomplish much toward an early diagnosis and radical surgical intervention.

The most important feature in diagnosis is the laryngological examination, which should be done with as great thoroughness as for intrinsic cancer of the larynx. Cancer of the laryngopharynx is frequently overlooked because a clear view is not always obtained. A good view of the hypopharynx is essential; the movements of the arytenoids on phonation and inspiration must be observed, and it is necessary to ascertain whether there is mucus in the piriform sinus which cannot be emptied by swallowing. The laryngeal picture may present the appearance of a chronic ulcer with raised margins and depressed ulcerating center, or that of a sessile growth projecting into the lumen. There may be a fixation of the arytenoids, or a large mass filling the cavity. If fixation of the arytenoids is present and no growth is discernible, it is likely that the piriform sinus is the site of the growth. On having the patient say "E," the larynx is elevated and it is possible to see a slight edema below the arytenoids. If the upper edge of an ulcer is seen, a malignant process is indicated. Further study with the roentgen rays, followed by direct laryngoscopic or esophagoscopic inspection and removal of a specimen for biopsy completes the examination.

Thirty years ago a small epithelioma of the lower part of the pharynx meant certain and painful death. Today, thanks to Trotter, good results are obtained in the surgical treatment of carcinoma of the larynx. The operative mortality is very low and the percentage of five-year cures is high, obviously because of early diagnosis.

Treatment and prognosis depend upon recognition of the starting point of the lesion. A growth occurring on the epiglottis may be successfully removed by proper operative procedure. Good results may likewise be obtained by early treatment of the lateral and posterior pharyngeal type of growth. Growths of the piriform sinus, in the epilaryngeal area, and in the postcricoid region of the hypopharyngeal area have the poorest prognosis; however, even in these cases early surgical intervention may be valuable.

MATHIAS J. SEIFERT, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Weinbren, M.: Encephalography with Small Quantities of Air (Laruelle). *Brit. J. Radiol.*, 1938, 11: 705.

The encephalographic method of Laruelle as practiced by Weinbren is based on the assumption that the three superior ventricles are placed in relation to the sagittal plane with mathematical accuracy in the normal skull, and any pathological condition would disturb the relationship of one or another of these ventricles in relation to the various base lines. It is consequently not necessary fully to outline the ventricles, as in the original method of procedure of Dandy (1918). To obtain the relationship of the ventricles to the sagittal plane and the base line—a line drawn across the supra-orbital margins—it is necessary to have only a small quantity of air, 5 c.cm. generally being enough, and not more than 10 c.cm. ever being required.

A lumbar puncture is effected with the patient in a sitting position, and after 10 c.cm. of fluid have been allowed to drip out, 5 c.cm. of filtered air are slowly injected. The patient is kept in this original position and the first film is taken from three to five minutes after the injection, in the anteroposterior position. Postero-anterior and other views may be taken after a successful picture has been taken in the original position.

The author believes that the Laruelle method may be valuable for the first investigation in any patient in whom encephalography or ventriculography may be indicated. It is simple and safe, causes few if any symptoms, and it may be done as an outpatient procedure. It is not claimed that this method can replace encephalography or ventriculography in every case, with larger quantities of air, but it will demonstrate whether any useful information is likely to be obtained by either of these procedures, and its use has been found valuable in cases of cerebral tumors, post-traumatic lesions, and epilepsy.

JOHN MARTIN, M.D.

Hardman, T. G.: A Position for Radiography of the Fourth Ventricle. *Brit. J. Radiol.*, 1938, 11: 726.

With the patient's nose and forehead touching the table, a lateral roentgenogram is taken following ventriculography, in an attempt to outline the fourth ventricle. In the experience of the author the fourth ventricle is visible only when the aqueduct is dilated and the third ventricle is larger than normal. In the normal case the failure of the fourth ventricle to fill may be due to the small size of the aqueduct or to a relatively rapid diffusion of air into the cisterna magna.

A well-filled aqueduct and fourth ventricle, without deformity or displacement, indicates an obstruction of the foramina of Majendie and Luschka, as might occur in the presence of arachnoiditis of the posterior fossa. Filling defects, such as inroads on the ventricular shadow, may be due to lesions occupying the space of the posterior fossa. A block of the aqueduct may be due to an inflammatory condition, and the absence of displacement differentiates a tumor.

The author disapproves of the use of thorotrast in roentgenological studies of the ventricles.

JOHN MARTIN, M.D.

Vaughan, W. W.: The Place of Irradiation in Acromegaly. *Am. J. Roentgenol.*, 1938, 40: 660.

Two papers on irradiation of the pituitary appear in the November issue of the *American Journal of Roentgenology*. The first deals with the chromophobe adenomas and the second is concerned with the chromophil adenomas. Curiously enough, the percentages of chromophil and chromophobe cells in the normal pituitary gland are 37 and 63 per cent, respectively, and the percentages of chromophil and chromophobe adenomas are the same. The symptoms of the chromophil adenoma are the well recognized symptoms of hyperpituitarism; local pressure symptoms occur late, if at all. The sella turcica was normal in 20.3 per cent. The signs, symptoms, and physical findings are carefully laid out and discussed. Of the group of 53 patients, 16 were operated upon 19 times without a single operative fatality. Although roentgen therapy often produced very dramatic results, the prognosis in acromegaly should be guarded, because 39.5 per cent of the patients treated in the eight-year period from January 1, 1928, to January 1, 1936, are already dead. The patient with acromegaly should be under constant medical supervision for the activity of the tumor is variable. Quiescent periods are followed by periods of increased activity. Personality changes, nervousness, polydipsia, polyuria, and headache should be a warning of activity of the tumor. The visual fields should be checked every six months.

The author concludes that irradiation should be tried for the chromophil as well as for the chromophobe adenomas before surgery is used, unless there is imminent danger of permanent visual impairment.

ADRIEN VERBRUGGHEN, M.D.

Schmidt, E. R.: Rapid Control of Intracranial Pressure. *Ann. Surg.*, 1938, 108: 520.

The author discusses the rapid control of intracranial pressure and reports his experience with this procedure.

In certain cases in which increased intracranial pressure must be reduced rapidly and in which the reduction must be maintained, an intraventricular ureteral catheter may be employed. The main risk is that of infection, of which there was positive

evidence in 6 cases. Two patients recovered and 4 died. The method was employed in 24 cases. It was not used in any case of cranial injury.

The procedure has the following indications: (1) to stabilize patients with long-continued pressure; (2) to aid in diagnosis; (3) to reduce emergency operations after ventriculography; and (4) to heal skin after a cerebral hernia.

ADRIEN VERBRUGGHEN, M.D.

Robertson, E. G.: Intracranial Aneurysms, with Special Reference to Surgical Treatment. *Australian & New Zealand J. Surg.*, 1938, 8: 132.

As most surgeons of today, the author of this article stands in no small awe of intracranial aneurysms, and, finally, is unable to decide what is the optimal form of treatment of such lesions. It is obvious to him that surgical interference often does more harm than good, and he clearly illustrates this point by several short case histories. In one case treated by ligation of the internal carotid artery the patient remained hemiparetic and developed other untoward symptoms, leaving both the patient and the doctor wondering if the cure were not worse than the disease. Before any surgical procedure, he advocates mechanical pressure for several days, intermittently and as a trial, over the carotid artery on the affected side. He has used "thorotrast" in the roentgenographic location of the lesion, but he recognizes its dangers and actually deprecates its use. He believes that repeated lumbar punctures in the presence of a bleeding aneurysm may be a life-saving procedure.

He points out that aneurysms, especially if calcified, may simulate by symptom and appearance an intracranial neoplasm, and that they are not infrequently the cause of focal epilepsy. He points out also that such lesions may remain dormant until disturbed by a traumatic interference of one sort or another.

JOHN MARTIN, M.D.

Adson, A. W.: The Treatment of Cranial Osteomyelitis and Brain Abscess. *Ann. Surg.*, 1938, 108: 499.

In the treatment of cranial osteomyelitis and brain abscess the surgeon should employ supportive measures, such as high caloric diets; and, when the infection is due to staphylococci or streptococci the occasional administration of vaccine and sulfanilamide is helpful.

Osteomyelitis of the skull should be treated similarly to osteomyelitis of other bones; this treatment consists of thorough sequestrectomy and removal of all dead bone. The wound should be cleansed with pure tincture of iodine and, if drainage is instituted, the drain should be removed within forty-eight hours and the scalp closed with sutures of silkworm gut.

The mortality will be lowered in the treatment of cerebral abscess if the surgeon employs some of the same principles that are used in the treatment of suppurative lesions elsewhere in the body.

In cases of suspected cerebral abscess resulting from infections about the ear, with indefinite localizing symptoms or with localizing symptoms and signs that are conflicting, the author has observed the rule of exploration of the temporosphenoidal lobe before exploration of the cerebellum on the side of the infected ear because of the higher incidence of temporosphenoidal abscess.

If, on study of the physical and neurological signs, a suspected abscess cannot be localized, the author believes that performance of cerebral pneumography is justifiable.

Adequate and continuous drainage should be instituted after encapsulation has taken place. If capsules are to be removed, it is better to remove them after the acute infection has subsided.

Rizzi, C.: Angioplastic Glioblastoma and Cyst of the Brain (Glioblastoma angioplastico e cisti dell' encefalo). *Tumori*, 1938, 24: 363.

In the evaluation of the pathological complex of tumor-cyst of the brain, the difficulty consists in deciding whether there is a primary tumor with secondary cyst formation or a primary cyst formation with subsequent neoplastic proliferation. The literature refers mostly to the former process. Rizzi reports the unusual case of a man, aged thirty-nine years, who had partial block of the anterior part of the left lateral ventricle and died suddenly during a suboccipital puncture. Examination at autopsy showed that neoplastic proliferation had occurred in a cerebral cyst. Numerous tumoral nodes were found in the wall of the cyst and their histological structure revealed that they belonged probably to the group of angioplastic gliomas, the presence of which has been reported at various times in cerebellar and medullary localizations, but only once in the cerebrum, when it was described by Heller under the name of "hyperplastic cavernous capillary angioma." Macroscopic and microscopic study of the present case revealed the existence of a tumoral complex consisting of a glioma with polymorphous cells and an angioblastoma, the two neoplasms being mixed together and combined with a large cyst containing a clear fluid and considered to be a lymphatic cystoma.

The histological examination of the blastomatous nodes showed that they were secondary formations of the degenerated wall of the cyst; there was no question of a cyst formation from compression of the surrounding cerebral substance by the blastomatous nodes or of the possibility of a cyst formation through necrosis of neoplastic tissue. Besides, various data in the history of the patient aroused the suspicion of a secondary origin of the blastomas of the cystic wall; several traumatic incidents preceded the appearance of the symptoms and one of them, a contuse trauma of the cranial vault, seems to have been the cause of the formation of the cyst through circulatory disturbances.

The secondary origination of the tumor from the wall of the cyst might be explained by the theory of

"hydric shock" proposed by Beneke, especially since in many cases the appearance of a cerebral tumor follows a traumatic action; abnormal stimulation of the glial elements by repeated hydric shocks would lead to gliosis and finally to gliomatous proliferation. Certain chemical conditions and especially the presence of the products of disintegration in the focus of softening must undoubtedly be accepted as playing their part. There was a marked hyperplasia of the blood vessels in the tumor, which condition also was explained by the action of hydric shock on the wall of the primary cyst. The result was an angioglioma, which in the present case was particularly well developed at the anterior pole of the cyst, as this was naturally most exposed to the hydric shocks. The sudden death of the patient during a suboccipital puncture was explained at autopsy by the presence of a marked edematous swelling of the lower part of the temporal lobe (temporal pressure cone of the French authors) which, at the moment when the cerebrospinal fluid was extracted, must have been sucked into the foramen of Bichat with compression of the cerebral trunk and fatal result.

RICHARD KEMEL, M.D.

Phillips, G.: Transsphenoidal Decompression for Pituitary Adenoma. *Brit. J. Surg.*, 1938, 26: 242.

This article presents several arguments in favor of the transsphenoidal approach in the operation for pituitary adenoma:

1. The operation is simpler than with the transfrontal approach.
2. Postoperative hyperthermia is rare after operation by the transsphenoidal route.
3. There is not so much possibility for damage of the frontal lobe with attendant mental deterioration.
4. Sudden death is not nearly so apt to supervene.

As carried out by the author, transsphenoidal decompression was performed through one nostril, with a special duckbill self-retaining retractor. This approach was found to provide adequate exposure of the tumor without the necessity of incisions at the juncture of the nose and cheek or beneath the upper lip. The early stages were carried out by an otorhinologist, who, after submucous resection of the cartilaginous septum, removed the vomer and the inferior and posterior parts of the perpendicular plane of the ethmoid bone, and thereby exposed the crista sphenoidalis which serves as a guide to the midline. The duckbill self-retaining retractor was then inserted, opened as widely as possible, and the mucous membrane over the conchæ sphenoidales was displaced until the anterolateral apertures of the sphenoidal sinus were seen. This is an important step in the procedure, as it insures an adequate exposure of the anterior wall of the sphenoidal sinus. The anterior wall was then removed and the mucous membrane which lines the sinus was drawn out. When this had been done the sella turcica was exposed and was found in each case to be eroded in several places. The remainder of the sella turcica was then removed with punch forceps and the tumor was exposed. The tumor was gently separated from the walls of the pituitary fossa with the tip of a small glass sucker tube which was passed around its periphery; after this maneuver the tumor could be grasped with pituitary rongeurs and drawn down into the sphenoidal sinus. During this procedure cerebrospinal fluid gushed forth and continued to drain freely. The nose was plugged with cotton for twenty-four hours, and the patient kept in Fowler's position to facilitate the drainage of the cerebrospinal fluid. This generally ceased after three days.

The operation as described has for its principal purpose the relief of pressure (either on the chiasma or on the diencephalon), and its results appear to be very satisfactory.

With regard to the risk of meningitis following transsphenoidal decompression, the author believes that it is slight, provided that the operation is carried out between the flaps of mucous membrane on either side of the nasal septum, vomer, and perpendicular lamina of the ethmoid. JOHN WILTSIE EPTON, M.D.

Pringle, J. H.: Traumatic Meningeal Hemorrhage, with a Review of 71 Cases. *Edinburgh M. J.*, 1938, 45: 741.

The author reports his experiences with 71 cases of traumatic meningeal hemorrhage, which were observed during the period from 1906 to 1923. Thirty-three patients had extradural hemorrhage, and of these, 19 had, in addition, a subdural hemorrhage. The types and locations of the hemorrhages are given in short histories of many cases. In addition to the usual history and methods of diagnosis, the value of percussion of the skull is emphasized. The normal percussion note was altered by fracture, or by an underlying intracranial hemorrhage. The author did not obtain much assistance in diagnosis from the pupil, other than that in some cases a wide, nonreacting pupil was encountered on the same side that the hemorrhage occurred. He stresses the value of the Macewen pupil and found it was always positive in alcoholic coma. The pupil of the patient in alcoholic coma, at rest, was contracted; but if disturbed, or if the skin of the face or neck was irritated, the pupil dilated widely and returned to the contracted state after the disturbance. This was a most valuable diagnostic sign.

It was noted that a subtentorial decompression may prove to be more effective than supratentorial decompression in many of these cases.

ROBERT ZOLLINGER, M.D.

Rowbotham, G. F.: The Treatment of Pain in the Face by Intramedullary Tractotomy. *Brit. M. J.*, 1938, 2: 1073.

In 1891, Horsley described the first operation on the sensory root of the trigeminal nerve. To Hartley in America (1892) and Krause in Germany (1892) go the credit for the extradural approach through the middle fossa, which formed the basis of operative procedures destined to obtain a great measure of success in the succeeding years. Both divided the

trunks of the nerve distal to the ganglion, but Krause in 1893 removed the ganglion itself. In 1901 Spiller and Frazier suggested division of the posterior root, and this modification profoundly influenced all subsequent methods of treatment. Apart from conservation of the motor root, the great advantage of the method is that a fractional anatomical section generally is possible. Immediately behind the ganglion, the nerve fibers run in groups corresponding fairly accurately to the three peripheral trunks, and can be isolated according to their relative positions, the mandibular and maxillary fibers occupying the lower and outer two-thirds of the root. Dandy in 1929 stated that as the posterior root approaches the pons, the fibers conducting the various types of sensation become rearranged into distinct physiological groups. Thus, he believed it possible to divide only those fibers which carry pain impulses. It is doubtful whether this arrangement occurs in all cases, and there is much experimental evidence to disprove it. However, within the brain stem, physiological grouping does take place, and in this location, fractional physiological section is possible. Sjöqvist in 1938 devised an operation in which he was able to divide the pain fibers in the descending limb of the trigeminal tract by an incision through the posterolateral aspect of the medulla oblongata and spare the sensation of touch so that the face did not remain unpleasantly numb.

The author has performed the operation in 3 cases; in 2 for the relief of neuralgia involving the ophthalmic division of the trigeminal nerve, and in 1 for the relief of severe and persistent migrainous headaches. In all 3, the results were very satisfactory. The advantages of the operation are that the face is not denervated completely; analgesia is greatest in the forehead; and the muscles of mastication are never paralyzed—an important consideration in bilateral cases. Moreover, the great superficial petrosal nerve (the nerve of tear-secretion) is far from the operative site and therefore the danger of "dry" eye is avoided. Since the loss of tear-secretion is thought to be the main factor in the production of corneal ulceration or "steaming," the latter troublesome complication which occasionally follows section of the posterior root is also obviated.

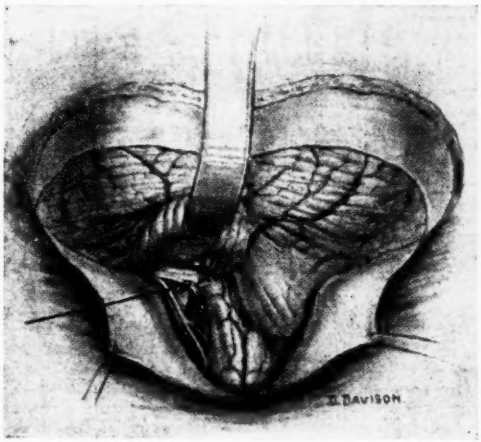

Fig. 1. Showing the site of the incision of intramedullary tractotomy.

ARTHUR S. W. TOUROFF, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Geschickter, C. F.: Gelatinous Mammary Cancer. *Ann. Surg.*, 1938, 108: 321.

Gelatinous carcinoma, which is a rare form of mammary cancer, occurred 83 times in a series of 2,300 breast cancers. The peak of its incidence is between the ages of forty-six and fifty years, as compared with the ages of forty-one and forty-five years for scirrhous cancer. The discovery of a lump was the first sign noted by the patient in 80 per cent of the cases, and in nearly half the known duration of the mass prior to examination was a year or more, the average time being four and three-tenths years. The average diameter of the tumor in the present series was 4.6 cm., and only 4 tumors were 10 cm. or over in diameter. The most prevalent sites in the breast are the outer upper quadrant and the central zone.

The present study indicates that a variety of mammary carcinomas may undergo mucoid changes which result in typical gelatinous carcinoma. Slowly growing scirrhous cancer, papillary adenocarcinoma, and adenocystic basal-cell cancer are the most frequent sources for growths in which the characteristic gelatinous material pervades the entire tumor structure.

There are four chief findings on clinical examination which suggest a diagnosis of gelatinous carcinoma: (1) the relatively small size of the tumor in comparison with the long duration of symptoms; (2) the protrusion and enlargement of the nipple on the affected side; (3) the cystic character of the growth on palpation, the growth being differentiated from a benign cyst by aspiration of characteristic mucoid material; and (4) the impression of rupture of the delicate membranes or a "swish" on firm pressure, as originally described by Halsted.

Mucoid cancers on gross and microscopic examination may appear to be diffusely or partially gelatinous. The gelatinous material has a characteristic gray, translucent appearance, resembling tapioca. Microscopically, mammary cancers which are diffusely gelatinous originate in papillary cancers, adenocystic basal-cell cancers, or slowly growing adenocarcinomas. The mucoid material is secreted by the epithelial cells of the tumor. Cancers showing a partial mucoid change are usually of the scirrhous type.

In the present series, 59 of the 83 cases of mammary cancer showed diffuse or typical gelatinous change. Of 45 patients who were adequately traced, 34, or 75 per cent, had survived the five-year period. Six patients eventually died of recurrent disease, one of these surviving sixteen years, and another eighteen years after radical mastectomy.

Of 24 patients with carcinoma showing partial mucoid change, 20 were adequately traced. Only 5, or 30 per cent, survived the five-year period. In the present series, the five-year survivals in all types of mammary carcinoma showing mucoid change (diffuse or partial) amounted to 60 per cent.

JOSEPH K. NARAT, M.D.

TRACHEA, LUNGS, AND PLEURA

Crafoord, C.: On the Technique of Pneumonectomy in Man. *Acta chirurg. Scand.*, 1938, 81: Supp. 54.

Crafoord, of the Sabbatsberg Hospital in Stockholm, reviews the literature on the subject of pneumonectomy and reports his experience with this operation in the cases of 16 patients. The technique which he has developed as a result of his study of the literature, and own experimental and clinical work is presented in detail.

The problem of wound infection is the one which has been least satisfactorily solved. In spite of careful protection of the wound from contamination, primary wound healing without any signs of inflammation occurred in only 2 of the 11 patients who survived operation long enough to determine the nature of the wound healing. The author believes that greater attention should be paid to this problem.

The combination of general and local anesthesia is considered best for the smooth accomplishment of the operation. Nitrous oxide, or cyclopropane, with oxygen, was used in each case. Local anesthesia was used regionally for the chest wall: infiltration anesthesia for the mediastinum, and endobronchial anesthesia for the mucous membrane.

The use of intratracheal anesthesia is facilitated by the use of a specially curved cannula which fits the larynx and pharynx. Tamponade of the bronchus to the affected lung, to prevent overflow of infectious material during the operation, is maintained by means of a flexible steel sound attached to the gauze plug. Rhythmic injection of the anesthetic mixture, followed by the free outflow of air during expiration, is accomplished by means of a Frenckner spiropulsator working in combination with an ordinary gas machine. The author believes that this is the only method which provides satisfactory ventilation during the period when the chest cavity is wide open. With its use he has been able to maintain anesthesia for hours without difficulty.

The chest-wall incision which has been found to give the best exposure is one which goes through the bed of the fifth rib from its junction with the vertebra to its cartilaginous portion. Through this approach one has good access to the hilus from the front and from the back. Careful preservation of the periosteum allows for air-tight closure of the chest wall in layers, without the use of pericostal sutures.

In the management of the hilus, the dissection of its structures is greatly facilitated by previous

division of the bronchus so that it may be put out of the way. The bronchial stump is clamped with forceps similar to those used in the Trendelenburg operation for clamping the pulmonary artery. In the case of carcinoma, the clamp is applied as close as possible to the bifurcation, and the lymph glands are carefully dissected away. Division of the bronchus is made between the third and fourth bronchial rings below the forceps, and after careful cleansing of the stump with an antiseptic it is held out of way by means of the forceps. The pulmonary vessels are then doubly ligated close to the pericardium so as to avoid the formation of bulging vascular sacs which might aid in the formation of thrombi and emboli. The bronchial artery branches, however, should be ligated as peripherally as possible, to avoid impairment of the blood supply to the bronchial stump.

After the blood vessels have been disposed of, closure of the bronchial stump is accomplished by means of a continuous suture of catgut, re-enforced by interrupted silk sutures after the distal cartilaginous ring has been carefully removed. The corners are invaginated and the whole stump is buried under the mediastinal pleura.

No drainage is used, and the intrathoracic pressure is controlled by the use of aspirations. Paralysis of the diaphragm is not used.

Operation was performed on 16 patients up to March, 1938. Twelve of these had malignant disease and 4 had not; 7 died within eleven days of the operation, and 3 died at later dates; 6 patients survived and were alive from three months to two years after operation. Of the survivors, 3 had carcinoma and 3 had tuberculosis, but in the latter group the clinical diagnosis had been carcinoma and each patient had marked bronchial stenosis.

The author presents his own case histories and, in a supplement, publishes photographs and microphotographs of autopsy specimens in 5 of his cases. There is also appended a detailed summary of all reported pneumonectomies done in dogs and in man.

RICHARD H. MEADE, JR., M.D.

ESOPHAGUS AND MEDIASTINUM

Penberthy, G. C., and Benson, C. D.: The Management of Certain Lesions of the Esophagus. *Ann. Surg.*, 1938, 108: 612.

Lesions of the esophagus are not common when compared with other lesions of the gastro-intestinal tract. The management of these lesions is well standardized nowadays, although some difference of opinion as to the one-stage and two-stage operations may exist.

The danger from perforation of the esophagus lies in its complications. A foreign body lodging in the esophagus or a lesion resulting from a foreign body is frequently seen by the endoscopist.

Pulsion esophageal diverticula need to be recognized early and treated by the two-stage operation, however the results obtained by the advocate of the one-stage operation should be recognized.

Cicatricial stenoses of the esophagus are seen most often in children following the accidental swallowing of lye. When first seen they should be treated conservatively. However, the resultant strictures of the esophagus may sometimes be very resistant to treatment.

The authors give detailed case reports of 3 cases of foreign bodies in the esophagus, 1 case of esophageal diverticulum, 1 case of congenital shortening of the esophagus, 1 case of stricture of the esophagus, and 1 case of rupture of the thoracic esophagus.

J. DANIEL WILLEMS, M.D.

Fiorito, E. S., and Rivas, A. E.: Hernias of the Esophageal Hiatus and Para-Esophageal Hernias (Hernias del hiatus esofágico y para-esofágicas). *Rev. méd. d. Rosario*, 1938, 28: 1025.

The authors give the following classification of diaphragmatic hernias according to their roentgen characteristics, which are the only ones that allow a precise diagnosis and provide definite surgical indications: (1) congenital hernias: (a) thoracic stomach, in which the stomach is in the thoracic cavity and the esophagus is very short; (b) gastric hernia with a short esophagus, in which part of the stomach is above the diaphragm; (c) hernia of the foramen of Bochdalek; (d) hernia of the foramen of Morgagni; (e) absence of the diaphragm; (2) congenital or acquired hernias of the esophageal hiatus: (a) paraesophageal hernia, in which the normal esophagus ends below the diaphragm, while part of the stomach is above it; (b) properly called hernia of the hiatus, in which the esophagus is normal but ends above the diaphragm, and part of the stomach is above the diaphragm; (3) traumatic hernias; and (4) diaphragmatic eventration.

The roentgen diagnosis of thoracic stomach does not offer any difficulties and there is no surgical treatment for the anomaly, which is compatible with a long life. In gastric hernia with a short esophagus usually ending at the level of the seventh or eighth dorsal vertebra, roentgen examination in the upright posture shows that the esophagus joins the apex of the upper part of the stomach, which appears as a dilated portion of the esophagus; study of the folds of the esophageal and gastric mucosas establishes the differential diagnosis from dilatations and strictures of the esophagus. Hernias of the esophageal hiatus constitute the most frequent type of non-traumatic diaphragmatic hernias. In paraesophageal hernia, roentgen examination in the upright posture may be negative in small hernias, and may show an air pocket superimposed on the cardiac shadow and a mobile fluid level in large hernias, but roentgen examination in the recumbent (Trendelenburg) dorsal posture generally demonstrates filling of the herniated portion, which is emptied in the ventral posture. Differentiation of this hernia from the other types requires examination of the terminal portion of the esophagus by means of complete filling with an opaque substance or by means of a thin coating of opaque substance in order that it may be

determined whether the esophagus enters the stomach below the diaphragm. In properly called hernias of the hiatus, roentgen examination in the upright posture raises suspicion because of the displacement of the lower portion of the esophagus and its angulation, the delayed passage of the opaque substance into the stomach, and the temporary formation of a pocket having the aspect of a diverticulum or of a dilatation in the terminal part of the esophagus; examination in the Trendelenburg posture confirms the presence of a herniated segment of the stomach.

It is evident that the exact diagnosis of the type of diaphragmatic hernia present requires a roentgenological examination in various positions and from various angles. Although the best films are obtained in the Trendelenburg posture, a most important factor is the upright posture, except in paraesophageal hernias in which examination in this posture is usually negative; however, this negativity allows exclusion of a gastric hernia with a short esophagus and of a properly called hernia of the hiatus, and thereby raises the suspicion of a paraesophageal hernia.

Hernia of the hiatus may not cause any symptoms, but the majority of the patients present digestive disturbances of intermittent and generally progressive incarceration or obstruction of the stomach, while some show cardiovascular or cholecystitic manifestations. The digestive symptoms which suggest the presence of a hernia of the hiatus are intermittent, non-progressive dysphagia; a sensation of gastric fullness after small meals; and the early temporary occurrence of painful disturbances after eating with relief in certain postures or after eructation or vomiting, and hydro-aerial noises.

RICHARD KEMEL, M.D.

Diviš, J.: A Contribution to the Clinical Study and Surgical Treatment of Benign Tumors of the Mediastinum (Contribution à l'étude clinique et au traitement chirurgical des tumeurs bénignes du médiastin). *J. de chir.*, 1938, 52: 601.

The author reports 10 cases of benign mediastinal tumor. In cases of mediastinal goiter diagnosis may be difficult, especially when the goiter forms a solid nodule completely detached from the thryoid gland or has an atypical localization in the posterior mediastinum. In the surgical removal of mediastinal goiter, an auxiliary sternotomy will be found of great value for entrance into the upper mediastinum. An incision is made in the sternum for several centimeters from the sternal incision downward in the mesial axis. One may thus proceed without injury to the pleura or large vessels, and the opening permits the introduction of one or two fingers for extirpation of the tumor. By this means the operation may be considerably shortened.

Among the nerve tumors of the mediastinum are mentioned neurofibroma, neurinoma, and ganglioneuroma of the sympathetic system. These are located usually in the posterior mediastinum and may be of an hourglass shape. They are usually benign and produce but few symptoms, such as slight dyspnea and pain. They may occur at any age, sometimes even in infancy, and may attain considerable size. Radical surgical removal gives good results.

Connective-tissue tumors of the mediastinum include lipoma, fibroma, and chondroma, and the author reports a very rare case of plasmocytoma.

About 200 cases of dermoid cysts and teratoma of the mediastinum have been reported. These, too, may appear in infancy and may attain a great size. They have been explained as monogerminal tumors. Of 190 cases reported by Hedblom, 86 terminated fatally without operation. Operation was performed in 104 cases. Radical extirpation was done in 50 cases with cure in 36, or 78 per cent. Partial intervention was accomplished in 56 cases with unsatisfactory results.

One of the rarest of benign mediastinal tumors is cystic lymphangioma, which has been attributed to the mediastinal penetration of cystic cervical hygroma. Purely intrathoracic tumors like the one described are probably of some other origin, possibly engrafted on rests of aberrant vessels.

Dermoid and other cysts are usually easily accessible because they are monolocular, but the extraction of cystic lymphangioma is very difficult because it is only vaguely limited by the surrounding organs and contains multiple cysts, some of which are small and cannot be removed; hence there is danger of recurrence.

Aneurysms of the aorta and of the anonymous artery greatly resemble mediastinal tumors in their clinical symptoms. It is usually easy to diagnose small aneurysms, but large aneurysms may present great difficulties in the differentiation from tumor, especially when they are located on the descending aorta. In aneurysm surgical treatment is futile. Anti-syphilitic and general hygienic measures are indicated. One reason for the prompt surgical removal of benign tumors of the mediastinum is their potential malignancy. EDITH SCHANCHE MOORE.

DELAYED INTERVENTION IN APPENDICEAL ABSCESS AND SPREADING PERITONITIS DUE TO APPENDICITIS

Collective Review

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PROBABLY nowhere in the entire domain of medicine and surgery is there a therapeutic procedure attended with more brilliant results than those obtained from the surgical removal of the vermiform appendix for acute appendicitis, provided that the operation is performed during the early stage of the disease. The postoperative complications are few, the operative mortality is practically negligible, and the end-results are excellent. Unfortunately, however, such a happy outcome of this disease does not always follow, as is indicated by the fact that some 20,000 deaths from appendicitis occur each year in the United States, and there is some evidence to show that this death rate is increasing [Sperling and Myrick (78), Walker (87), Hobler (33)].

Deaths from acute appendicitis are due almost solely to some phase of peritonitis, whether it be directly (from toxemia, profound sepsis, and ileus) or indirectly (from the later complications of peritonitis, such as intestinal obstruction, intestinal fistulas, subphrenic abscess, empyema, or pneumonia). It is therefore obvious that the mortality is largely dependent upon the incidence of perforation and that if in all cases of acute appendicitis an early correct diagnosis were made and appropriate treatment applied, the death rate would promptly fall to a low level.

That much can be gained by an active program of lay education has been demonstrated in Philadelphia where an attempt was made by the Department of Public Health to attain earlier hospitalization of patients with acute appendicitis, where the public was taught the importance of abdominal pain and the necessity of early medical consultation, as well as the danger of promiscuous and common use of cathartics and purges in attempts at self-medication. Without doubt if the pernicious practice of purgation for abdominal pain could be abolished countless lives would be saved.

The present high death rate from acute appendicitis is a challenge to the surgeon in his management of the ruptured case, complicated as it is by some degree of peritonitis. Thus Sworn and Fitzgibbon (83) reported a mortality rate of 21.1 per cent in a series of 226 cases of general peritonitis at St. Thomas' Hospital, Finney (23) 22.08 per cent in 240 similar cases; Haggard (29) 24.7 per cent in 186 cases; Keyes (41) 27.55 per cent in 98 cases; and McClure and Altemeier (56) 21.5 per cent in 65 cases (46.6 per cent in 15 cases of general peritonitis plus abscess). These same authors give the mortality for cases with localized abscess as follows: Sworn and Fitzgibbon, 4 per cent in 487 cases; Finney, 4.56 per cent in 438 cases; Haggard, 5 per cent in 379 cases; Keyes, 7.3 per cent in 315 cases, and McClure and Altemeier, 4.2 per cent in 117 cases.

That the mortality of appendicitic peritonitis is excessively high is not a new observation. As long ago as 1902 A. J. Ochsner (61, 62) in speaking of acute appendicitis stated that "in fatal cases, the patient practically always dies as the result of diffuse peritonitis." In considering the spread of infection from the appendix, he maintained that the normal anatomical arrangement of the adjacent structures was extremely efficient for the walling off of infections and the prevention of spread to the general peritoneal cavity. He believed that the failure of the normal defensive mechanism to limit an inflammatory process to the right iliac fossa was due largely to the peristaltic waves of the small intestine, and that if peristalsis was active it might be responsible for the dissemination of the infection throughout the general peritoneal cavity. He further believed that intestinal peristalsis could be inhibited by the abstinence of food and fluid by mouth, and contended that with the intestine at rest the omentum was materially assisted in its attempts to localize the infection. He then enumerated his three cardinal points of treatment: (1) complete avoidance of food or fluids by mouth, (2) abolition of cathartics or large enemas (although small nutrient enemas were permitted), and (3) removal of the stomach contents by gastric lavage. In 1892 he began to employ this so-called Ochsner treatment in preference to immediate operation. It is noteworthy that his mortality in cases with early diffuse peritonitis dropped to less than one-fourth

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of what it was formerly when operation was promptly performed.

Sherren (74), in 1905, while insisting upon appendectomy for cases seen within from the first twenty-four to thirty-six hours of the disease, believed that when seen later than this they should be tided over the attack by means of conservative measures, and appendectomy performed at a later date. His mode of treatment in these cases was similar to that of Ochsner. The English frequently speak of the Sherren treatment, and the term "Ochsner-Sherren treatment" is one quite generally used.

In 1894 Richardson (70) stated that in his opinion there were some cases seen "too late for the early operation and too early for a safe late operation." This dangerous period was believed by him to be during the third, fourth, or fifth day of the attack. While not an advocate of routine deferring of operation in such cases, he pointed out the dangers of breaking down protective adhesions and favoring the spread of infection in the peritoneal cavity by a badly timed operation.

In spite of the teachings of Ochsner and Sherren the conservative treatment of appendiceal peritonitis has never been very generally adopted by surgeons, even though the mortality of general or widespread peritonitis has remained consistently high when early operation was performed.

Jopson and Pfeiffer (38), writing in 1923, stated that the method of deferred operation "has never commanded anything like universal attention and it seems to us from a review of the literature of the last six years, that it is perhaps less popular today than when we last reviewed the subject in 1916."

In 1926, Guerry (28) reported a mortality of 8.2 per cent in 85 cases of general peritonitis treated by immediate operation, with a mortality of only 1.6 per cent in 123 similar cases treated by deferred operation. Treatment in these cases was exactly according to the principles laid down by Ochsner. Guerry's report of his results in cases of diffuse peritonitis, which were superior to any previously recorded, has caused a renewal of interest on the part of surgeons in the Ochsner plan, that is, delay of operative intervention.

Wilkie (88), an eminent authority on appendicitis, stated in 1929 that he usually advised immediate operation, once the diagnosis had been made. Continuing, however, he states that in dealing with cases of localized peritonitis considerable judgment is required and expectancy may not infrequently be justified.

Coller and McRae (16), reviewing in 1930 the results of treatment of acute appendicitis over a five-year period at the University of Michigan Hospital, found the mortality in the peritonitis group to be 52.6 per cent (or 21 per cent if 3 patients actually moribund at the time of admission were excluded). Because of this shockingly high mortality the practice of immediate operation in this group of cases was abandoned in 1931 and a program of delayed operation adopted.

During the past several years a tremendous amount of literature on the subject of delayed versus early operation in cases of acute appendicitis complicated by rupture has appeared. While as yet there is no unanimity of opinion in the matter and ardent proponents of both methods of treatment are to be found, the advocates of deferring the operation, at least for a sufficient period of time to permit restoration of physiological balance, seem to be increasing in number. Considerable difficulty is experienced in the attempt to summarize and reconcile the opinions of various authors because of the lack of uniformity and of standardization in the use of terms. Thus, such phrases as local, localized, early diffuse, diffusing, and early general peritonitis lead to many different interpretations. For example, a case of very recent perforation with soiling and consequent congestion and exudation of the regional peritoneum may, on the one hand, be grouped with the cases of simple acute appendicitis, or it may be classified under the general heading of early diffuse or early general peritonitis. In case the latter classification is used it explains the recommendations of certain writers for early operation in cases of diffusing peritonitis, and should many such cases be included in the general peritonitis group, a statistical review of the cases may be made to show very good results from prompt operation in cases of general peritonitis.

Too much emphasis cannot be placed on the fact that the expectant form of treatment is not designed as a method of treatment of uncomplicated acute appendicitis. On the contrary, it is proposed for certain complications, i.e., circumscribed or non-circumscribed peritonitis caused by perforation of the appendix. The treatment of simple acute appendicitis is appendectomy. Likewise, in borderline cases in which there is doubt as to whether or not perforation has occurred, the majority of surgeons favor prompt operation, especially when the patient is seen during the early hours of the attack. The consideration of a waiting policy should arise only when little doubt exists that rupture has occurred. In cases operated on within the first few hours following perforation the results of early intervention are on the whole excellent. The patient's condition is good, important adhesions have not as yet had a chance to

form, and experience has shown that the mortality is only slightly higher than in the unruptured cases.

While the time at which perforation occurs cannot always be told with accuracy, and while the duration of the attack is not always a reliable index of the stage of the disease, generally speaking the unperforated cases and those very recently perforated will ordinarily be seen within the first forty-eight hours. Very commonly the diagnosis of recent rupture is made only at the time of operation, and since this diagnosis is quite frequently not made pre-operatively, it is convenient and proper to group cases with recent rupture along with those of simple acute appendicitis. Because the end-results of operation are so uniformly good in these cases of very early rupture, certain authors [Babcock (1), Maes and McFettridge (55)] who believe that a history of sudden cessation of pain is indicative of perforation insist that prompt operation should be performed in such instances. Others [Maes *et al.* (52, 53, 54), Trinca (86), Bailey (2), and Haggard (29)], also believing that a history of the ingestion of a purge makes the probability of perforation great, advise immediate operation in cases with such a history.

TYPES OF ACUTE APPENDICITIS WITH PERFORATION FOR WHICH DELAYED OPERATION MAY BE EMPLOYED

1. *Cases with localized inflammatory infiltration.* In contrast to the group of cases with recent perforation to which reference has already been made, in these cases a longer period of time has usually elapsed following the perforation, the patient being seen more than forty-eight hours after the onset of the attack, usually during the third, fourth, or fifth day of the disease. In turn, the defensive mechanisms of the peritoneum have had a chance to begin their combat against the spread of the infection in the effort to wall off the process from the general peritoneal cavity. Loops of small intestine and the greater omentum have become agglutinated to the appendix and cecum, and adhesion formation has begun. While a small amount of pus may be present, this type of case is to be distinguished from the large monolocular abscess. There may be multiple small abscesses in or beneath the thickened and edematous omentum. These cannot be drained surgically, and even though a tumor mass can be detected on abdominal or rectal examination, it will be found to consist principally of inflamed thickened and edematous tissues. It is obvious that drainage operations can accomplish but little in such cases, since as a matter of fact there is little or nothing to drain. Removal of the appendix at this time is particularly hazardous, justifying the traditional fear of the so-called danger period from the third to the fifth day (negative phase). Operation is dangerous because even with the greatest care, protective adhesions are broken down, nature's barriers are destroyed with consequent spread of the infection to uncontaminated portions of the peritoneal cavity, and there is a real possibility of conversion of a local into a general peritonitis. Furthermore, it may be difficult to find the appendix and a prolonged search for it becomes necessary. Moreover, the tissues are vascular, friable, and edematous, so that troublesome bleeding is not uncommon and trauma to the ileal or cecal walls may result in the distressing complication of a fecal fistula. It is impossible by any type of surgery completely to eradicate the inflammatory process, as in the cases in which the process is limited to the appendix.

Delay of the operation, on the other hand, provided the patient can be carefully watched in a hospital and is kept at rest in bed with peristaltic activity reduced to a minimum, will allow the inflammatory process to subside, and appendectomy may safely be performed at a later date as an interval operation. In the event that extensive suppuration follows, the resultant abscess can be dealt with according to established surgical principles, although according to many present-day writers the indications for surgical intervention in such cases are becoming more strict.

Those who advocate early operation in this group of cases do so in the belief that prompt removal of the appendix, once the diagnosis of acute appendicitis is made, is the treatment of choice in all cases, irrespective of the stage of the disease, and that early removal of the focus of the infection is most essential.

2. *Cases of appendix abscess.* It is quite impossible to make a fine distinction between the masses due to inflammatory infiltration and those due to abscess formation. In fact, the latter may be regarded as a more advanced stage of the former, just as elsewhere in the body the brawny induration of an early cellulitis may pass on to the stage of suppuration. In these cases the fact that the peritonitis is circumscribed and localized is indicative of a satisfactory resistance to the infection, particularly on the part of the peritoneum. Love (50, 51) regards abscess formation as the most fortuitous outcome of a ruptured case, and states that in such cases we are truly dealing with the "laudable pus" of our forebears.

In the more advanced stages the diagnosis of abscess is not difficult. A large mass may be felt

frequently bulging into the rectum, and presents definite softening or even fluctuation. Relaxation of the anal sphincter often occurs, and diarrhea may be present. In such cases, especially in children, edema of the genitalia may develop. Such an abscess may spontaneously rupture into the rectum, bladder, or vagina; it may enlarge upward and medially and point toward the free peritoneal cavity; it may travel upward along the paracolic gutter to form a subdiaphragmatic abscess; it may burrow posteriorly into the retroperitoneal tissues; and occasionally may travel downward beneath Poupart's ligament to point on the surface of the thigh. In years gone by, surgical intervention has been advised in those cases in which there was unmistakable evidence of the presence of pus in accordance with the old surgical axiom, *ubi pus ibi evacua*. Adequate drainage of the abscess cavity has been the main purpose of the operation and removal of the appendix at this time was practiced only when the organ could be easily found and easily removed.

3. Cases of general peritonitis. By far the most unfavorable course of the disease following perforation is seen in the spread of the infection throughout the general peritoneal cavity, with the production of a generalized or diffuse peritonitis. Here, because of low resistance on the part of the host, or a particularly virulent organism or combination of organisms, localization of the infection does not occur. Certain authors [Wilkie (88, 89), Hertzler (32)] hold that early and sudden perforation of the appendix is frequently responsible for this type of case, believing that the unprepared peritoneum cannot cope with the infection when it is so suddenly flooded with fecal material, a condition which takes place following perforation in the obstructive type of appendicitis.

It was for this type of case that Ochsner originally suggested the conservative form of therapy which still bears his name, and it is concerning the treatment of these cases of general peritonitis due to perforation of the appendix that considerable controversy still exists. The purpose of the expectant treatment is to improve the patient's general condition by the parenteral administration of fluids, electrolytes, glucose, and transfusions, if necessary, and to assist him in combating his infection by supportive measures, including general and intestinal rest, the latter being achieved by duodenal suction. By withholding food and fluids by mouth, the general peritoneal inflammatory process is permitted to become localized, and, when definite abscess formation has taken place, these collections of pus may be drained and the surgical procedure carried out at a time when the patient is better able to withstand a surgical operation.

The advocates of early operation in such cases are no longer able to argue for drainage of the peritoneum, as the futility of drainage of the entire peritoneal cavity has long since been demonstrated [Yates (91), Buchbinder (11)]. In fact, many of the advocates of early operation in general peritonitis now favor tight closure of the deep layers of the wound, with drainage of the superficial tissues of the abdominal wall only, and their principal argument for early operation is the removal of the appendix, as they consider it important that the original focus of infection be removed. It is argued by some that in these cases of general or non-circumscribed peritonitis there is an absence of protective adhesions, in contrast to the findings in cases of circumscribed peritonitis. They therefore believe that prompt operation will do far less harm than in the latter type of case. Thus, there is a considerable group of surgeons who heartily endorse expectant treatment for localized abscesses or infiltrations, but with equal enthusiasm recommend early operation in cases of general peritonitis.

OCHSNER TREATMENT

The details of the Ochsner régime are essentially those originally emphasized by Ochsner. The patient is put to bed in the semi-Fowler position with heat to the abdomen either by means of hot applications or an electrical bake. Morphine is used freely in order that the patient may be drowsy and contented and kept as quiet as possible. A point stressed by Ochsner was the rule that absolutely nothing was to be given by mouth. At the present time the necessary fluids, consisting of 5 per cent glucose solution, and occasionally with physiological saline or Ringer's solution, are given by the intravenous route. The twenty-four-hour fluid intake for an adult ranges between 3,500 and 5,000 c.cm. At least 1,500 c.cm. of urine should be excreted daily. Ochsner originally suggested gastric lavage for removal of the stomach contents. The modern method of keeping the stomach empty is by the use of the duodenal tube with Wangensteen suction. Enemas are contraindicated and fluids are not administered by way of the rectum. The gastro-intestinal tract is given as complete rest as possible. Usually considerable improvement in the patient's condition is noted within the first twenty-four hours after treatment is started. The temperature and pulse rate begin to drop, the abdomen becomes less spastic and less distended, and the general condition improves. Abdominal distention subsides and vomiting ceases.

In the course of a few days the temperature usually falls to normal and at this time small amounts of fluid can be started by mouth. The twenty-four-hour daily urine output is carefully charted, the blood chlorides and serum proteins are frequently checked, and disturbances in body chemistry are promptly corrected by appropriate therapy.

REVIEW OF THE LITERATURE

Among the most notable contributions to the literature on the subject of deferred operation within recent years have been the papers by several British surgeons. Love, writing in 1924 (49) and again in 1933 (51) on a study of the mortality of operations performed on the different days of the attack, showed that operations performed on the third, fourth, or fifth day carried the highest mortality. The mortality on the first day was 1.1 per cent, on the second day 2.8 per cent, and from the third to the fifth day 10.2 per cent. After the fifth day the mortality declined as the duration of the attack lengthened. He believed that during this dangerous period from the third to the fifth day the resistance of the patient is at its lowest point, that the natural immunity has become exhausted and acquired immunity has not yet become established, and the patient is in what is spoken of as a "negative phase." He regards the disappearance of cutaneous hyperesthesia above Poupart's ligament (the presence of which denotes a distended but unruptured appendix) as good evidence of perforation, and in such cases, as well as in cases first seen between the third and the fifth days, advises delayed intervention. He concluded that in the cases treated by the delayed plan the mortality was only one-half of that occurring when cases were operated upon immediately. He noted that the expectant plan of treatment was apt to be less successful at the two extremes of life. He found complications approximately three times as numerous in the cases operated on at once as in those treated conservatively. He insisted that the delayed form of treatment should be attempted only in a hospital and formulated his rule of the four F's of treatment: (1) Fowler's position, (2) fomentations, (3) fluids only (saline by any convenient route, only a minimal amount of water being allowed by mouth), and (4) four-hourly chart, indicating careful observation. Under certain circumstances he believed the surgeon's hand might be forced. Thus, if after twenty-four hours of expectant treatment the pulse rate and temperature fail to fall or the patient is complaining of increasing pain and discomfort, operation may be indicated. His mortality in this unsuccessfully delayed group was 6.4 per cent. In the event that abscess formation occurs the abscess is allowed to absorb unless it increases in size or the patient shows marked symptoms of toxemia. In these cases incision and drainage of the abscess without attempt at removal of the appendix is indicated. He believes, however, that in approximately 65 per cent of the cases spontaneous resolution of the inflammatory process will occur, and a clean appendectomy can be performed some three months later.

Evidence along similar lines is presented by Stanton (79) as the result of an analysis of his own cases and those recorded in the literature. He is convinced that the operative mortality of acute appendicitis is definitely related to the duration of the inflammatory process. This, he believes, is represented by the time interval between the onset of the attack and the time of operation. He notes that when the operation is performed during the first twenty-four hours of the attack, the mortality is practically negligible or in the neighborhood of 1 per cent. The mortality is 2 or 3 per cent in operations performed during the first half of the second day, but after forty hours the rate rises rapidly and thus operations performed during the third day are attended with a mortality of 10 per cent. He believes that operations on the fourth and fifth day are even more dangerous than on the third day. However, beginning with the sixth day the operative mortality begins to decline and by the end of the ninth or tenth day it has dropped back to approximately the level of the cases operated upon during the second day. He believes that the mortality is definitely related to the peritoneal involvement and is convinced that in these cases and in the later cases the mortality can be lowered by deferring operation and resorting to the Ochsner régime.

Sworn and Fitzgibbon (83) in an analysis of the results of treatment of 2,126 cases of acute appendicitis at St. Thomas' Hospital over a ten-year period conclude that in cases in which a palpable mass is present conservative treatment is the procedure of choice. However, in certain of these cases "urgency of symptoms" may make immediate operation necessary. In such cases they believe that the surgical procedure should be confined to drainage of the abscess. For cases of diffuse peritonitis they advise and practice immediate operation, as according to them "removal of the appendix would appear to be the only rational form of treatment to adopt." When appendectomy is performed, drainage of the peritoneum seems to be of minor importance.

Sherren (75), in commenting on his twenty years' experience at the London Hospital, states:

"The only change I have made has been to greater conservatism and more patience in dealing with cases of appendix abscess."

Bailey (2), in discussing the rationale of the Ochsner-Sherren treatment of appendix peritonitis, states that this plan of treatment is not merely postponement of the operation, nor a substitute for operation, but rather it is a preparation for operation, and he insists that it should always be carried out in a hospital, the patient being carefully watched so that surgical intervention can be carried out at any time, should the necessity for it arise. His rule for the application of the conservative régime is as follows: In cases of over fifty hours' duration, conservative treatment is to be considered with the following exceptions: (1) when hyperesthesia is present, which he believes indicates an unruptured appendix, (2) in patients under five years of age, (3) in cases in which a differential diagnosis cannot be made so as to satisfactorily exclude perforated peptic ulcer and other perforating lesions, (4) in cases in which general peritonitis has developed, and (5) in cases in which there is a history of recent ingestion of a purge. He states that after six and one-half years of experience with this method of treatment he has nothing but praise for it. In enumerating its advantages he concludes that subphrenic abscesses are almost unknown, pylephlebitis has not occurred, and intestinal obstruction is much less common than in cases treated by immediate operation. In cases of general peritonitis in which the patient's condition is critical, as shown by a pulse rate of 140 or more with a boardlike abdomen and other unmistakable signs of general peritonitis, he believes that conservative treatment is best and that by this method nature is aided in transforming a general peritonitis into a condition of localized abscesses. However, in cases of general peritonitis, when the patient's condition will permit, he believes that the expeditious removal of the appendix with suprapubic drainage is the best form of treatment.

Wilkie (89) states that "just as early operation is beneficent and life saving in the obstructive cases so may it be meddlesome and dangerous in the cases seen late where nature has walled off the infection and an inflammatory lump has formed." He believes that in such cases the patient should be kept in the hospital and observed. If the pulse and temperature do not rise the process should be allowed to resolve. On the other hand, if a large abscess is present when the patient is first seen it should be opened in the simplest manner possible. No search is to be made for the appendix, if it is not seen presenting in the wound. In ruptured cases the infection is produced in large part by many anaerobes, and the danger of cellulitis of the abdominal wall is ever present, even though the focus of infection is removed and the pelvis drained. Wilkie, therefore, advocates leaving the abdominal wound practically open. It may be packed lightly with gauze. He cautions against the use of catgut sutures, which he believes act as a pabulum for anaerobes. Hydrogen-peroxide irrigations are subsequently given and a prophylactic dose of serum for gas infection is given at the time of operation. He states that in a bad case the presence or absence of a cellulitis of the abdominal wall may be the factor which determines the outcome.

Bevan (4) in discussing acute appendicitis and its complications agrees with other authors that in cases seen within the first twenty-four hours immediate appendectomy should be performed. He believes that in this group of cases the mortality will be about 1 per cent. In cases seen during the second twenty-four hours of the disease he likewise advises early operation, but in these cases the mortality rises to between 1 and 3 per cent. When a patient is first seen during the third, fourth, or fifth day, he believes that the case should be carefully studied in order to see if the process is still progressing or if walling-off is taking place, with a general improvement in the patient's condition. If the symptoms are progressing and there is a possibility of general peritonitis, prompt operation is definitely indicated. If, on the other hand, the symptoms are subsiding, a waiting policy is in order. If a mass forms and shows a tendency toward involution, conservative treatment should be advised. In such cases appendectomy should be performed in from six to eight weeks after recovery from the attack. If there is a definite abscess formation, extraperitoneal drainage is indicated and this may often be through the vagina or rectum. Bevan makes no fine distinction between an inflammatory mass about an inflamed appendix and a frank abscess. He believes, however, that such inflammatory infiltrations should be left alone, whereas obvious abscesses should be drained. He notes that one-half of the patients with inflammatory masses going on to recovery without surgery have recurrent attacks in the future and therefore urges removal of the appendix after recovery from the attack. However, in the patients with abscess in which drainage has been necessary, recurrences in the future have been far less common and in these cases it is not as necessary to insist upon appendectomy. Bevan believes that if an abscess is drained and a fecal concretion is removed only

about 5 per cent of the patients will have a recurrence of their trouble. In the management of cases of general peritonitis he follows the Murphy plan, which consists of early operation with removal of the appendix. At this time he also makes a small counter incision above the symphysis and introduces a tube into the pouch of Douglas. He then washes the peritoneal cavity with one gallon of normal salt solution at 105° F. He believes this irrigation procedure to be of great value and that it will save countless lives. He emphasizes the necessity of adequate drainage and condemns the practice of tight closure of the abdominal wall in cases of peritonitis.

Babcock (1) calls attention to the dangerous types of appendicitis. In these types he believes that operation should usually be delayed. He groups the patients according to the following plan: (1) those with an initial or secondary chill indicating that toxic infectious material is entering the blood stream or raising the question of the existence of a pylephlebitis; (2) those exhibiting the occurrence of diarrhea, which is often indicative of a very septic type of appendicitis, quite likely to be due to a virulent, streptococcal, or pneumococcal infection; (3) those showing mental excitation, delirium, or coma; (4) those with clammy skin, cold extremities, high rectal temperature, with black or yellow offensive vomitus; and (5) those with an abscess in the process of localization. However, when a sudden lull in the symptoms occurs he advises prompt operation. He remarks that in cases more than forty-eight hours old, and in which there is evidence of much free pus in the abdomen, much of this pus will be absorbed and an abscess will form about the appendix under a régime of absolute rest. If, however, the patient is very toxic or there is a spreading peritonitis, and any operation is to be performed, simple drainage without search for the appendix is advised. He prefers for this a small muscle-splitting incision. In localized abscesses in the right lower quadrant he urges extraperitoneal drainage through a muscle-splitting incision, warning against drainage through the peritoneal cavity. For larger abscesses in the lower pelvis drainage through the rectum is recommended.

Bower, Burns, and Mengle (8) stress the importance of peritonitis as the cause of death in cases of acute appendicitis. A considerable group of these cases of peritonitis are operatively induced. The factors responsible for such operatively induced peritonitis are the failure of recognition before operation of rupture with a localizing process, and also failure of recognition of such a process at the time of operation and the consequent performance of radical surgery, such as removal of the appendix, under these circumstances. These authors emphasize the importance of correct diagnosis of a localizing process which may be going on to abscess formation. If such a process is present, conservative treatment is most certainly indicated. They stress the danger of the liberation of antigen into the peritoneal cavity by the trauma of an ill-advised operation during the period of localization, and believe that the amount of antigen liberated when the appendix is removed under such circumstances is sufficient materially to increase the mortality. They emphasize the value of spinal anesthesia and of preperitoneal palpation at the time of operation in order to avoid meddlesome surgery. They likewise present clinical and experimental evidence to the effect that the incidence and also the mortality of spreading peritonitis in man and dog are increased by the administration of laxatives. They believe that the administration of perfringens antitoxin will reduce the mortality of spreading peritonitis because of the fact that the clostridium welchii could be demonstrated in the flora of spreading peritonitis in man and the dog in 60 per cent of the cases.

Haggard (29) emphasizes the increased danger when the disease has spread beyond the confines of the appendix. He refers to the fatal third or fourth day and states that it is not improbable that some of these cases would be better off if not operated upon during that particular period. He places in the same class as important factors responsible for death, conservative treatment given early and surgical treatment given late in the disease. He states emphatically that in the majority of cases there is no conservative treatment after a purgative has been given. He quotes both Ochsner and Lord Moynihan as favoring conservative treatment in these late cases when a purgative has not been given. He cautions against the removal of the appendix when a well walled-off abscess is being drained because of the breaking down of important adhesions. He notes that if an enterolith is found in the abscess cavity at the time of drainage, even though the appendix is left in, rarely will the patient have further trouble. He emphasizes the point that if the Ochsner plan of non-interference is decided upon, this conservative treatment should be continued, and that the surgeon should not change his course and operate upon the patient while the process is still severe.

Sperling and Myrick (78) reviewed 518 cases of acute appendicitis which occurred in the University of Minnesota Hospitals from 1932 to 1935. Since 1929 cases showing extension of the infection beyond the appendix have been treated con-

servatively. They find that in the case of inflammatory masses, frequently the mass will disappear and surgery may be postponed until a later date, at which time an interval appendectomy is performed. If, on the other hand, definite evidence of abscess formation is noted, drainage of the abscess is performed in an extraperitoneal manner. They believe drainage of these abscesses by way of the rectum is attended with considerable danger while colpotomy drainage is relatively safe. While they believe that the results in cases of abscess or localized inflammatory masses have been improved by conservative treatment, they are not able to present statistical evidence to show that cases of general peritonitis, treated conservatively, do better than those treated by prompt operation. However, in spite of statistical data, they believe that, in general, patients with diffuse peritonitis treated conservatively will do better than those operated upon promptly.

Kirtley and Daniel (42), in a study of 1,000 consecutive cases of acute appendicitis, found 314 patients with ruptured appendices; 118 patients had appendiceal abscesses. Five of the last group died, which gave a mortality rate of 4.2 per cent. Immediate operation was performed in 63 of these cases and delayed treatment practiced in 55. All of the 5 deaths occurred in the group of 55 in which operation was delayed. In the group of cases of spreading or generalized peritonitis, there were 103 cases with 38 fatalities, or a mortality rate of 36.9 per cent. Operation was deferred in 25 cases and in this group 8 patients died, a mortality rate of 32 per cent for the group with deferred operation. This rate was lower than the mortality rate for the group operated upon immediately, which was 38.5 per cent. These authors believe that each patient must be considered individually and if delayed operation is decided upon, ample fluids and morphine should be given, the surgeon reserving the right to intervene if the patient does not respond to the conservative measures. They deem drainage of the right iliac fossa and of the pelvis important when the appendix is ruptured and free pus is present. The complications of intestinal obstruction and fecal fistula were rare in their experience. These authors emphasize the fact that delay in operation is justified only when it is quite certain that the appendix has ruptured and that the peritonitis is not spreading, or when it seems probable that the general condition of the patient may be improved. If there is any doubt about the question of rupture or non-rupture immediate operation should be performed.

Coller and Potter (17) report their experiences over a period of three years with cases of general peritonitis treated by the method of delayed operation. During this time 336 patients were admitted to the University of Michigan Hospital with a diagnosis of acute appendicitis. Among this number, there were 85 with spreading peritonitis, and for them the deferred operative treatment was carried out. The average duration of the disease was three and one-tenth days before entering the hospital. Every case was considered on its own merits and deferred operation was not carried out unless the patient was seen in consultation with a senior surgeon. The conservative treatment carried out was essentially that originally outlined by Ochsner. Among the 85 cases so treated there were 8 deaths, a mortality of 9.3 per cent. In the 77 patients who recovered, the inflammatory process subsided without operation in 29; a localized abscess developed in 48, in 32 of which drainage of the abscess and appendectomy were done; while in the remaining 16 patients drainage of the abscess alone was performed. Patients discharged from the hospital after having had an abscess drained or having had no operation were directed to return for appendectomy in eight weeks. Coller and Potter mention the presence of edema of the external genitalia as evidence of a large pelvic abscess and suggest that when this finding is noted the presence of an abscess should be suspected. Most of the deaths occurred in children, a matter which opens the question of the applicability of the plan of deferred operation for children. All of the children on whom the Ochsner treatment was carried out were sicker than the members of the adult group. They believe that the mortality in children is high because of late diagnosis, home treatment with purging, and the fact that localization is less likely to occur because of the small and underdeveloped omentum; also, because of the fact that the young child tolerates infection less well and the body chemistry is less stable than that of adults, which makes conservative treatment less efficient. They conclude that while the deferred operative treatment is less efficient in children than in adults, any form of treatment is less efficient in children, and they believe that delayed operation should be employed in children with general peritonitis. However, under no circumstances do they defer operation in cases of appendicitis associated with pregnancy, since the presence of the enlarged uterus prevents localization of the infection. They agree with other authors that in pregnancy, operation should be performed on the suspicion of acute appendicitis. They emphasize the fact that deferred operative treatment is not medical treatment and that it implies that operation will be performed in the

future. After three years' experience with deferred operative treatment they believe that it has definite advantages over other methods of treatment for cases of spreading peritonitis.

Alton Ochsner (63) believes that it is a mistake to judge the extent of the pathological lesion by the duration of the attack and he urges that cases be considered individually rather than by any fixed rule. He agrees with the majority of surgeons that even though the appendix has recently perforated (within a few hours) early operation to remove the focus of infection is desirable. However, when protective adhesions have started to form he believes that operative interference is definitely contraindicated and that late cases should be dealt with conservatively. When, however, a well-defined abscess develops, surgical drainage is required and at this time the appendix should not be removed unless the situation is such that its removal can be done easily and quickly.

Seifert (73) believes the results of the present-day treatment of appendiceal abscess are not good. He cites figures to show that the mortality from appendiceal abscess is increasing while the total operative mortality is decreasing. The latter fact he believes is due to better treatment of the cases with general peritonitis. He believes that the treatment of abscess is difficult and should always be done by an experienced surgeon. He proposes the following plan: if (1) the abscess is unquestionably localized, (2) the fever is moderate, (3) pain is slight, and (4) the general condition and bowel activity are good, the conservative treatment is to be used.

However, if pain and fever persist in spite of conservative management for two or three days, the patient is operated upon without any attempt being made to remove the appendix, care being used to protect the free peritoneal cavity from contamination.

Suermondt (82) records his experiences in the Leiden Clinic during the past twenty-five years. He believes that in acute appendicitis without extension to adjacent structures and in acute appendicitis associated with diffuse peritonitis the appendix should be removed at once. On the contrary, in cases where there is extension of the infection beyond the confines of the appendix and in abscesses, the treatment should be conservative. In such cases the body has already walled off the infectious process from the remainder of the peritoneal cavity. Hence, if early appendectomy is performed important protective adhesions are broken down and the peritonitis may become generalized, and there is also the danger of the formation of fistulas. Suermondt does not believe that the forty-eight-hour rule is very useful, inasmuch as the stage of the disease can better be determined by clinical findings than by the time factor. Under the usual conservative measures, if the inflammatory infiltration subsides by resorption, appendectomy is performed six weeks later. If an abscess forms, operation is indicated only if it points upward or medially, thus showing an extension toward the free peritoneal cavity. Extension downward does not constitute an indication for operation. Spontaneous rupture into the rectum, vagina, or bladder is not regarded as serious. If upward and medial extension indicates operation, simple drainage should be employed and a search for the appendix never made. The author is convinced that the expectant treatment of appendicitic abscesses and infiltrations will yield better results than immediate appendectomy. Under the conservative plan above outlined he had only 3 deaths in 407 cases, a mortality of 0.7 per cent. In 256 of these cases in which expectant treatment only was employed there were no deaths. In the remaining 151 cases in which an abscess was drained there were 2 deaths. In 405 cases having secondary appendectomy there was 1 death, or a mortality of 0.3 per cent. The author contrasts these figures with those reported by other authors (Abel, 4.05 per cent; Rieder, 7 per cent; Stich, 5.1 per cent) who have employed immediate operation.

Mont Reid (68) warns against misinterpretation of the use of conservative treatment. He fears that the total mortality of acute appendicitis may actually be increased unless the entire medical profession learns the clear indications for the conservative therapy and that it has no place in the acute unruptured case. He states that he often experiences difficulty in deciding which cases should be treated conservatively. Before the onset of abdominal distention, in cases of general peritonitis, he prefers to remove the appendix through a small McBurney incision, with or without drainage. In well walled-off abscesses, he believes that it is good surgical judgment to observe the clinical course of the disease for a time before a decision for or against surgical intervention is made.

Orr (64) emphasizes the fact that a patient with a ruptured appendix and an inflammatory mass at the site of the appendix is best treated conservatively because of the fact that prompt operation will not enable the surgeon completely to eradicate the infected tissues as is the case in the early stages of the disease. He points out that many of these inflammatory masses will subside completely under conservative treatment and appendectomy

can be performed at a later date. If, on the other hand, under conservative treatment, the mass increases in size, and definite evidence of abscess formation is present, then surgical drainage should be performed and this should be done extraperitoneally, if possible. Ordinarily, at the time of the drainage of the abscess, appendectomy is not wise.

Lehman and Parker (46) record their experiences at the University of Virginia Hospital with the conservative treatment of appendix abscesses. A careful comparison is made with similar cases treated by prompt operation in earlier years in this same clinic and the results from conservative treatment are shown to be much superior. In their most recent series of abscess cases 83.3 per cent were treated along conservative lines and 65 per cent were carried through without operation. By the term "abscess" they include both inflammatory masses and definite suppuration. The mere fact that a localized abscess is present does not constitute an indication for surgery.

It was found necessary to abandon conservative treatment, either early or late, in certain cases, and these were classified as "forced operations." Thus surgical intervention became mandatory in cases complicated by acute intestinal obstruction or impending perforation of the abscess into the rectum or through the abdominal wall. The authors report no deaths in the cases treated without operation and, in contrast to this, a mortality of 4 per cent in cases treated by immediate elective operation and of 20 per cent in a small group of cases treated by late elective operation.

Furthermore, patients treated by early elective operation suffered over twice as many complications as those treated conservatively throughout and those who had late forced operations. They also remained in the hospital one-third again as many days, and were febrile for a period about 25 per cent longer.

Patients successfully treated by conservative means are urged to report for interval appendectomy in from six weeks to three months. The authors state that "the absence of complications, the short hospital stay, the brief period of pyrexia and the absence of any period of drainage, are of considerable significance" and conclude that "*successful* conservative treatment is the most desirable method of treating this group of cases, not only from the point of view of the prospect for recovery but also from the point of view of severity of the patients' illness and cost of hospitalization, to add nothing of the pain, odor, nuisance, and expense associated with a drained abscess."

While they do not discuss in detail the management of cases of general peritonitis, they merely mention that they prefer the conservative treatment for this type of case.

Pattison (65), in reviewing the question of the treatment of diffuse peritonitis, states that as the result of his study of a group of patients and reported series in the literature, he has been unable to conclude that either the conservative method or that of prompt operation is so satisfactory that it can be employed to the total disregard of the other. He believes that in cases of diffuse peritonitis the patient must be individualized. However, even in cases of general peritonitis he rather favors early operation as long as the patient's general condition is good, his reason for this being the removal of the focus of infection. On the other hand, in early cases of abscess, that is in patients with abscess whose symptoms have been present for less than seventy-two hours, be believes conservative treatment is important in order that adequate walling-off of the infection may take place. He calls attention to the fact that in cases of acute appendicitis complicated by diabetes mellitus the mortality is high.

Miller and Turner (58) discuss the surgical management of appendicitis in children. They agree upon immediate operation in all cases before perforation. They find that the mortality in such cases is practically nil. If it is thought that the process is subsiding operation may be postponed. In the group of cases showing localized inflammatory masses at the time that the patient is first seen, that is, cases of perforation in which there has been set up from the start an adequate defense mechanism, conservative treatment is favored. These so-called abscesses may vary considerably in size and location and often are detected only by rectal or bimanual examination. Following this conservative treatment during the attack, the patients are routinely advised to return in three or four months for appendectomy. An increase in the size or spread of the abscess is occasionally noted. The abscess may point anteriorly, laterally, or deep in the pelvis. If such is the case they may be drained through a small incision, in fact, with an extraperitoneal approach. In patients with perforation and lacking an adequate defense mechanism, there is usually found the obstructive type of appendicitis with a perforation of considerable size, and frequently the streptococcus is the predominant organism. The process then becomes generalized rather than localized and the clinical findings suggest a rapidly spreading peritonitis. The authors admit that there is considerable controversy as to the best form of treatment for these cases. They, however, recommend surgical removal of the source of infection combined

with adequate drainage when drainage seems necessary. In these cases the resistance of the peritoneum becomes decreased in proportion to the decree to which the blood supply of the bowel is disturbed by gaseous distention. The authors find the use of the duodenal tube, cecostomy, or appendicostomy of distinct value. They agree that it is impossible to drain the general peritoneal cavity adequately, but nevertheless they believe that local drainage seems to be of value. In this group of cases they report on 163 patients so treated with a mortality of 22.7 per cent.

Deaver and Martin (21), in reporting the results of their study of a group of 235 consecutive cases of acute appendicitis in children under fourteen years of age, state that in their series most of the patients were operated upon immediately after admission. In a few cases, operation was delayed. The delayed cases, however, were those of children who were extremely ill because of far-advanced peritonitis. For these cases the Ochsner-Deaver treatment was instituted. If an improvement was noted in twelve hours, conservative treatment was continued, whereas if improvement did not take place, operation was then performed. They state that by postponing operation in these cases, they feel certain that some patients who could not have survived immediate operation were saved. They agree with most other writers that the cases in which delayed operation is indicated in children are relatively few. They believe that Sir James Barrie has injured the reputation of a useful method of treatment by advising delayed operation in late cases of acute appendicitis without discrimination. On the other hand, in the cases with localized abscess, Deaver and Martin state that there is no need for urgency and that the patients respond better if the operation is delayed for a few days and conservative treatment employed during this period. However, they do not continue conservative treatment for a long period of time, but rather advise surgical drainage of the abscess when its presence is once established.

Herman Taylor (85), in a discussion of appendicitis in the aged, points out that if the process has already localized into a palpable abscess when the patient is first seen, conservative treatment is best. However, in the earlier cases, i.e., those seen before the third day, there is an even chance that the patient will develop diffuse peritonitis. Therefore, in such cases prompt operation is urged. Taylor believes it important to use a small muscle-splitting incision, and usually merely places a drain down to the appendix.

Bunch and Doughty (12) state that they believe that the question of when to operate is just as important as the question of how to operate. In cases of perforation with diffuse peritonitis they advise postponement of the operation until the patient's resistance is increased and localization has occurred. In cases of abscess they advise surgical drainage in an extraperitoneal manner, if possible; also, if possible, removal of the appendix at the time of operation.

Nassau (59) states that there is a small group of patients in whom delay in operation is the wiser and safer course of procedure. In such cases the Ochsner treatment will allow localization of the infection to take place and the resulting abscess can be safely drained at a time when the patient's condition has been improved.

Stein (80), in his discussion of a paper by Chester L. Davidson, states that whenever he has been encouraged to delay surgery in a case of peritonitis associated with abdominal distention, high fever, and leucocytosis he has rarely been disappointed in the results obtained. Delaying operation in such cases until the patient has had an opportunity to localize the infection has always given favorable results. While Stein has seen patients with peritonitis operated upon promptly, and was subsequently convinced they would have done better with delayed operation, on the contrary, he has never seen a patient treated expectantly who he thought would have done better by prompt operation. He believes that this method should receive much more extensive consideration than it has in the past.

Young (92) of South Carolina, in a clinical study of 2,288 cases of appendicitis, reported 388 ruptured cases. Of these 55 were treated conservatively and 49 developed localized abscesses, with 1 death, a mortality rate of 2 per cent. The remaining 6 patients died of general peritonitis without being operated upon, giving a mortality of 12.6 per cent for the cases treated by conservative measures.

Bower (7), in commenting on the lowering of the death rate from acute appendicitis in Philadelphia as the result of public education, noted that surgeons had fewer cases of spreading peritonitis, and that the mortality in these cases was lower because surgeons were becoming peritonitis-conscious and were approaching the fulminating cases more deliberately.

A. C. Taylor and E. R. Schmidt (84) state that prior to 1928 nearly 100 per cent of their cases of acute appendicitis (in all stages) were treated by operative procedures. Becoming convinced of the value of conservative measures in certain cases, operation was performed in only 75 per cent of their cases from 1930 to 1934.

Gile and Bowler (26), from a study of 901 cases of acute appendicitis complicated by rupture, conclude that an appendiceal abscess is a localized process and does not call for urgent measures.

In their discussions of various aspects of acute appendicitis, the following authors make favorable reference to conservative treatment for certain types of cases: Kolodny (44), Holcomb (34), McDonald (57), Davis (20), and Reschke (69).

While much has been written during the past five years concerning the expectant treatment of the ruptured appendix, this method has by no means been generally accepted by surgeons. During this same five-year period many papers have likewise appeared, either condemning the method or expressing frank skepticism as to its superiority over other methods. Other authors have reported their results in large series of cases which were treated by prompt operation. They suggest that these results are satisfactory or that they compare favorably with the results obtained by deferred operation. They frequently emphasize some particular point in technique or certain details of the postoperative care. Among the most emphatic objectors to deferred operation is Kennedy (40), who in his discussion of the reaction of the peritoneum as it affects the surgical pathology of peritonitis, violently attacks conservative forms of treatment. Such treatment, he states, aims solely at the prevention of absorption of toxins by the peritoneum. He contends that it is not the peritonitis which will give the final and fatal dose of infection but rather the complications of the peritonitis which demand the most careful consideration. In other words, he operates for the complications of peritonitis and not the peritonitis itself. He does not endorse the use of the Fowler position and in general peritonitis regards the peritoneal cavity as a huge carbuncle with numerous pockets or abscesses. He believes that the treatment of peritonitis is evisceration of the abdominal cavity, in order that adhesions are separated, abscess cavities are thus broken down, and partial bowel obstructions are released. The operation is then completed by very free drainage of the peritoneal cavity by means of a cofferdam of gauze. He concludes by saying that the physiological surgeon's practice of adding more days of delay in the case of the patient who already is too late is a most disastrous way of teaching the general profession earlier work.

Trinca (86) of Australia advocates immediate operation in the early cases even though signs of general peritonitis are present. If the process seems to be subsiding, he believes one may allow it to subside before operating, but even in these cases he believes that immediate operation is best. With regard to cases seen after forty-eight hours, presenting a localized peritonitis or an abscess, he mentions the common belief that operation is especially dangerous from the third to the fifth days. He states in refutation of this idea that "the gentle surgeon will not have trouble in this dangerous period." In late cases with unmistakable evidence of general peritonitis, the mortality is high. Since statistics show that with the Ochsner-Sherren method of treatment there is a lowering of the death rate, he believes that the lesson to be learned here is that one can safely defer operation long enough to improve the patient's general condition with fluids and glucose, prior to operation. However, he prefers to operate while the peritonitis is still general, and does not wait for the doubtful localization into abscesses. He likewise believes in immediate operation if a purge has been given. If an abscess has already formed, it should be drained and the appendix left alone if it cannot be removed easily. Most appendix abscesses should be drained. If the appendix is not removed at this time, it should be done later, although not too soon. In the peritonitis cases, if it is possible to remove the appendix completely, he favors non-drainage, and makes no attempt to remove free fluid from the abdominal cavity, unless it is contaminated with fecal material.

In an excellent discussion of peritonitis in its more general aspects, Horsley (35) considers the topic of appendicitic peritonitis in some detail. He compares the ruptured appendix to a perforated peptic ulcer, believing that in both cases bacteria continue to be admitted into the peritoneal cavity until the opening in the viscus is closed. In order to stop or prevent this constant reinfection of the peritoneum, he believes that operation should be performed in every case of acute appendicitis as soon as the diagnosis is made, at whatever stage the disease may be. At the time of operation removal of the appendix is considered to be of paramount importance. He stresses the importance of the McBurney incision, as he believes that a long abdominal incision with extensive sponging and rough handling of the tissues in peritonitis cases is probably more dangerous than leaving the case alone, and trusting to nature to wall off the infection and allow an abscess to form. In his group of 727 cases of appendicitis treated according to these principles there was 1 death in 60 cases of abscess, or a mortality of 1.67 per cent, and 1 death in 29 cases of spreading generalized peritonitis, or a mortality of 3.45 per cent.

Nuttal (60) states that while it is generally agreed that immediate operation should be done

in the early cases without perforation, the advisability of operation in cases seen after forty-eight hours, with or without a palpable mass, is disputed. It is said that surgical interference is particularly dangerous in the third, fourth, and fifth days, that during this period the natural immunity to infection is exhausted, and acquired immunity has not yet been established, the patient being in a negative phase. The author believes that there is no pathological evidence of a negative phase and that there is no justification for the assumption that delayed operation is best for cases of acute appendicitis seen two or three days after the onset. He calls attention to the disadvantages of expectant treatment and illustrates them by examples.

Kogon (43) believes that expectant forms of treatment are injudicious because of the fact that an exact diagnosis of the pathological changes in the appendix is often impossible, and the fact that the degree of the pathologico-anatomical lesion does not always correspond with the clinical findings. He believes that the hesitation of surgeons to operate in the presence of inflammatory infiltrations is not justified or warranted by clinical experience. On the contrary, he regards an infiltration or a resistance in the ileocecal region as an indication for operation, since these findings are indicative of severe destructive appendiceal changes. Furthermore, he contends that a recession of the clinical signs and symptoms during the first three days or later does not indicate that the further course of the disease will be favorable and therefore should not contraindicate operation. Also, operation in the quiescent or interval stage does not assure an uneventful postoperative course. Even in the presence of infiltrations which regress and become smaller under expectant treatment there is always the danger of exacerbation of a quiescent infection. He therefore concludes that emergency appendectomy in all stages of acute appendicitis appears to be the most rational method of treating this disease.

Herrick (31), in a discussion of the treatment and mortality of acute appendicitis with peritonitis, records his experience in this type of case. In a total of 217 cases of acute appendicitis with peritonitis there were 5 deaths, a mortality of 1.84 per cent. He believes that most important of all is immediate operation in every case, once the diagnosis is made. He believes that no possible excuse of holiday, professional or social, or other engagements should be permitted to break this rule. In spite of Ochsner's teaching, he believes that operation should be done at once on diagnosis. He believes that there has been sufficient delay before the patient is seen by a competent surgeon and queries why treatment should be still further delayed. At the time of operation exploration is never attempted and in practically every case the appendix is removed at the time of operation. With regard to drainage, he asks "what is gained by closure of the abdomen based purely upon unsubstantiated theories of peritoneal resistance except a risk?" He believes that until the temperature has become normal and the patient is out of danger all drains should be left in place, but that they may be loosened or shortened from time to time.

C. R. Davis (18), in a critical analysis of 35 deaths in a personal series of 1,130 cases of appendicitis, attempts to learn if any of these deaths might have been avoided by a plan of treatment different from the one used. Prompt operation was performed. From the available literature on the subject the author is not convinced that delayed operation has any important advantages over immediate operation. He comments on the differences of opinion among various surgeons as to the indications for deferring operation. Thus some advocate deferred operation in cases of beginning spreading peritonitis, and others in the more advanced cases of generalized peritonitis. Likewise with regard to age, while many do not delay operation in children or in elderly patients, few authors are specific in their statements as to what constitutes the age limits. Davis concludes that were he afforded a second opportunity to care for these 35 fatal cases, he might have reduced his mortality by 1 per cent. Assuming the correctness of this conclusion, he doubts the wisdom of discussions concerning delayed operations, particularly inasmuch as at the present time definite and specific instructions cannot be given so that all can follow the same procedure intelligently. He believes that at the present time more progress can be made by more accurate diagnosis, more skillful surgery, and earlier operation in all cases. If delayed operation is to be practiced it should only be in the fulminating cases.

Boyce and McFettridge (9) believe that conservative treatment is rarely indicated in appendicitis at the extremes of life. They mention the fact noted by Eliason that the clinical diagnosis may be incorrect and that the appendix is actually unruptured in some cases when perforation is believed to have taken place. In such cases a deferred operation is objectionable. They believe that it is not the peritonitis itself which is the fatal factor but rather the toxemia which accompanies the peritonitis. They insist that when expectant treatment is to be employed the patient

should always be in a hospital. They condemn the institution of expectant treatment merely on the basis of the number of hours which have elapsed since the beginning of the attack. Furthermore they assert that a history of purgation should not be taken to be an indication for expectant treatment. They also state that expectant treatment should not be persisted in despite a rising pulse, or persistence of pain or vomiting, or in the face of any other signs or symptoms that indicate spreading of the infection. They agree heartily with Ochsner's original statement that if the expectant treatment is employed, absolutely nothing should be given by mouth. They believe that the development of an abscess is the most favorable outcome of a ruptured appendix. When localization is definitely occurring a delayed operation is thought to be best. If operation is performed too early in such cases, especially when removal of the appendix is undertaken, adhesions may be broken down and the infection may spread to the general peritoneal cavity. If, on the other hand, localization does not appear to be taking place after rupture, immediate surgery is indicated.

Maes, Boyce, and McFettridge (54), in their study of 910 cases of acute appendicitis between the extremes of life (thirteen to thirty-nine years inclusive), found a total mortality of 4.6 per cent. When patients were seen during the first twenty-four hours of the disease, the mortality was only 2.7 per cent, whereas when they were seen after twenty-four hours, the mortality was 6.5 per cent. The authors believe, therefore, that the time factor calls for consideration in delayed operations. In their series operation was delayed in 50 cases for from twenty-four hours to twenty-one days. Twenty-four of these patients were "really never very sick." In only 4 of the remaining 26 did localization take place, and 7 of the 26 died, a mortality of 27 per cent, or 14 per cent for the whole group. They conclude that certain cases which are seen late and in which localization has definitely occurred or is occurring can be handled satisfactorily by conservative measures. They believe, however, that any patient seen early and most patients seen late should not be so treated. In concluding, they state that the only conservative treatment of appendicitis is radical. They likewise emphasize the value of cecostomy, which is most effective when done at the time of operation.

Maes and McFettridge (55), in a consideration of acute appendicitis, at the extremes of life, point out the higher death rate in children and in patients past middle age. In discussing cathartics and purges, they regard the ingestion of a purge as an indication for operation, whereas cessation of pain after taking a cathartic constitutes "the last call to operate." They further state that "the case for expectant treatment in appendicitis is not yet settled, but *very* occasionally should it enter the discussion of appendicitis at the extremes of life." Even in middle life they adopt expectant treatment with many misgivings and feel that in children and old persons it has no place. Their chief reason against delayed treatment is that the peritonitis is not the most important complication of appendicitis, but rather the toxemia.

Bauer (3) states that it is difficult to evaluate comparative statistics because of the lack of definite criteria as to the presence of peritonitis, the differences in terminology regarding the type of peritonitis, and the difficulty of determining the circumscription, extent, and severity of the process. He uses the terms circumscribed and noncircumscribed peritonitis. In his cases of noncircumscribed peritonitis there were wide fluctuations in the mortality curve from year to year. The mortality increased with the duration of the disease before operation; it was greater in males than in females, and higher in childhood than in old age.

The mortality of circumscribed peritonitis showed similar fluctuations. Cases in which the appendix was directed medially or upward were responsible for the greatest number of deaths. The two disputed questions in the cases of noncircumscribed peritonitis are the advisability of immediate operation after forty-eight hours and the wisdom of drainage of the peritoneal cavity. The author maintains that operation should be done in every case irrespective of the duration of the condition, as long as the patient is not moribund. He also contends that the abdomen should be closed without drainage in all cases of noncircumscribed peritonitis. In cases in which the bed of the appendix is necrotic or a persistent oozing occurs, local drainage of the dangerous area is advisable, but this does not mean any attempt to drain the free peritoneal cavity. He states that circumscribed peritonitis lends itself less favorably to any single plan of management. In cases of not more than five days' duration the results have proved that the mortality is lowered when operation including the removal of the appendix is performed immediately. This is true whether a palpable mass is present or not. The author's mortality for this type of case with this treatment was 6 per cent. In cases of abscess of more than five days' duration, conservative treatment is thought to be safer, but in the majority surgery will become necessary later.

Gray and MacKenzie (27), in reporting the experiences at the Mayo Clinic in the treatment of acute appendicitis, found a relatively high mortality in patients with diffuse peritonitis who were treated primarily by the usual conservative methods. Thus in 27 such cases, there were 9 deaths, a mortality of 33.3 per cent. In explanation of these figures, it is to be noted that 7 patients were never operated upon because their condition was too critical at all times to justify such a procedure. Of the patients in this group who ultimately came to operation, the mortality was only 10 per cent. In contrast to this, the mortality was 14.5 per cent in a group of patients operated upon primarily in the presence of diffuse peritonitis. The authors believe that one should adopt no dogmatic plan of management but that individualized treatment should be given according to the condition of the patient. They emphasize the fact that experience and judgment are essential in the care of such patients, and believe that at the present time it is impossible to formulate any dogmatic policy for treatment.

Schullinger (72) reports the results of his study of the cases of acute appendicitis seen at the Presbyterian Hospital in New York over an eighteen-year period. In acute appendicitis the mortality was 0.59 per cent. In acute appendicitis with local peritonitis the mortality was 1.0 per cent. In acute appendicitis with acute spreading diffuse peritonitis the mortality was 17.02 per cent and in acute appendicitis with progressive fibrino purulent peritonitis the mortality was 88 per cent. He notes that the mortality in the first two groups is falling while in the latter two groups of cases it shows an alarming increase. A second factor to be considered in the decrease of the mortality is the type of anesthesia to be used. Schullinger apparently operated promptly on all cases but mentions that in any case in which difficulty is encountered in removal of the appendix the attempt at removal should be abandoned and simple drainage done. In the case of a peritoneal abscess, drainage with the least possible trauma and in the quickest and simplest manner is the procedure of choice. In the cases of general peritonitis, careful attention to the postoperative management is regarded as highly important.

Lewin (48) in his clinical study of acute appendicitis in old age states that "the treatment of these cases is always operative." When indicated he believes that the peritoneal cavity should be drained adequately. If removal of the appendix proves to be difficult or unwise at the time of operation, because of the patient's general condition, drainage only should be done.

Leonard and Derow (47) discuss the mortality factors in acute appendicitis as noted in a study of 1,000 cases operated upon at the Newton Massachusetts Hospital, between 1923 and 1933. In their series there were 47 deaths with a mortality of 4.7 per cent. Of the patients over fifty years of age, 50 per cent had general peritonitis or abscess. Eighty-four per cent of the patients were operated upon within ten hours after the onset of symptoms and in this group there were no deaths. The authors conclude that the mortality in the average case of acute appendicitis is not due to a single factor but to a combination of factors.

Lamon (45) reports his experience in 206 cases of acute appendicitis, all of which required drainage. These patients living in the Rocky Mountain district had to travel a long distance to reach a hospital. This factor of delay, plus a long, rough ride, probably accounted for a fairly high percentage of perforation. He employed prompt operation in all cases, invariably using a right rectus incision. He always removed the appendix and provided free drainage. In 68 cases of local abscess his mortality was 1.16 per cent and in 54 cases of peritonitis it was 24.07 per cent. He feels that in spite of the adverse circumstances making early treatment impossible or difficult, these results compare favorably with those of other authors.

Kehl and Rentschler (39) report the results of their study of 126 cases of acute appendicitis complicated by peritonitis treated at the Reading, Pennsylvania Hospital, during a six-year period. In 18 cases with acute gangrenous or suppurative appendicitis with localized peritonitis, there were 2 deaths. There were 41 cases of acute appendicitis with abscess formation and 2 deaths in this group. There were 67 cases of acute appendicitis with spreading or general peritonitis and 12 deaths. Other than for a moderate period of pre-operative preparation, none of the patients was treated by the expectant method. In all of the peritonitis cases, free drainage of the abdominal cavity was employed. The appendix was removed in practically every case. These authors believe that drainage of the peritoneal cavity under such circumstances is wise and that postoperative care is especially important in cases of peritonitis.

Cayford (13) reviews 614 cases of acute appendicitis with a mortality of 3.42 per cent. His discussion is concerned largely with the matter of drainage. He apparently practices early operation in all cases. In 265 cases of spreading or diffuse peritonitis his mortality was 9.01 per cent when drainage was employed, and only 3.24 per cent when drainage was omitted. In 21 of 75

cases of local abscess, tight closure was practiced with no fatalities. The remainder of the 75 cases were drained, with 1 death. Cayford notes in his conclusions that there is a definite trend at the present time to drain less frequently, and calls attention to the fact that if drainage can be safely omitted the hospital stay is definitely shortened. With regard to the indication for drainage or non-drainage, he believes each case to be an individual problem and that there can be no standardization for the procedure. In general, if the peritonitis is advanced and the peritoneum is dark, hemorrhagic, and edematous, and has thus become incapable of further absorption and elimination, surgical evacuation of the exudate is required as well as adequate drainage. If, however, the patient's condition is satisfactory and he is showing good resistance to the infection, the simple removal of the focus of infection with aspiration of the exudate at the time of operation, followed by tight closure, will suffice. Again the presence of considerable edematous necrotic material at the base of the appendix is an indication for drainage.

In discussing the management of general peritonitis, Breitman (10) agrees with many other authors that the problem of drainage of the peritoneal cavity is unsettled. In his opinion treatment of peritonitis should include: (1) removal of the source of infection, (2) removal of infected exudate and prevention of its further formation, (3) restoration of normal conditions of the circulation, the last being best accomplished by complete closure of the abdominal wound.

He objects to attempts at removal of the exudate from the peritoneal cavity, as it contains beneficent antibodies, which are thus lost to the body. If, however, the exudate is found to be very purulent and to contain necrotic tissue or intestinal matter, it does more harm than good and should then be removed at the time of operation. He believes that if drainage is required, it is best provided by insertion of the drains between the anterior abdominal wall and the omentum in such a way that they will not come in contact with the intestines.

Gamble (24) calls attention to the fact that in the case of a ruptured appendix, anaerobic organisms are present and that while they may be overcome in the peritoneal cavity, they may gain a foothold in the wound. This wound infection may be fatal. Therefore, he proposes a method whereby the appendix is removed, drains are placed, and then the peritoneum is closed to the drain. The wound is packed, this pack being removed twenty-four hours later in order that the wound may be exposed to the air. He believes that the adoption of this method will lower the death rate from this type of peritonitis.

DeCourcy (22) notes that the mortality in acute appendicitis is still excessively high. He believes that it can be lowered by lay education regarding the importance and significance of abdominal pain, and by improved technique in the handling of the ruptured cases. His paper is chiefly concerned with the latter phases of the problem. He apparently advises prompt operation in all cases and believes that deaths in cases of ruptured appendicitis are usually due to distention from intestinal obstruction rather than to the infection of the peritoneal cavity. He believes that decompressive cecostomy at the time of appendectomy will greatly lower the mortality.

Hoseman (36) discusses the management of severe peritonitis due to perforations in the gastro-intestinal tract. In these cases he advocates early surgery to remove the focus of the infection. This is followed by aspiration of the pus and then the introduction of from 50 to 100 c.cm. of ether into the peritoneal cavity before it is closed, and, finally, by a prophylactic appendicostomy. He reports a mortality of 11 per cent in this group of cases, which he compares to the usually reported mortality of from 40 to 80 per cent in these severe types of peritonitis.

Shute, Jr., (77) reports his experiences in the treatment of perforated cases by employing immediate operation, consisting of appendectomy and cecostomy. His mortality rate was 22.5 per cent in 40 cases of diffuse peritonitis; 15.09 per cent in 53 cases of localized peritonitis; 16.66 per cent in 24 cases of early abscess—a mortality of 17.94 per cent for the group. Employing the afore-mentioned procedure, he noted that in cases of diffuse peritonitis in which drainage was employed the mortality was 24.2 per cent, whereas in similar cases which were not drained, the mortality was only 14.4 per cent. Likewise, in cases of localized peritonitis, the mortality was higher when drainage was employed, being 17.1 per cent in the drained cases and 11.1 per cent in the undrained. On the contrary, with early abscess, the mortality was 10 per cent with drainage and 50 per cent when drainage was omitted. When the results were compared with a group of cases of rupture complicated by local peritonitis, early abscess, or well-walled-off abscess, in which immediate appendectomy without cecostomy was performed, it was found that the mortality was slightly higher with cecostomy. Shute states that he has just started using the conservative method for diffuse peritonitis, as he is convinced that one should not operate upon these cases at once.

Jones (37) reports his results in the treatment of 75 cases of diffuse general peritonitis due to acute appendicitis with perforation, with the low mortality of 1.4 per cent. He attributes his good results to the fact that operation was performed promptly, the appendix being removed, and appendicostomy being performed by the introduction of a small rubber tube into the cecum through the stump of the appendix. In some of the cases the wound was closed tightly about the tube, and in others drainage was employed.

Handley (30) stresses the importance of ileus as a cause of death in cases of appendicitic peritonitis. He states that peritonitis is rarely general even at the time of death. Beginning in the pelvis it gradually spreads upward to the hypogastric region. During this upward spread the stomach, jejunum, and transverse colon remain uninfluenced and unparalyzed until the patient is moribund. Hence, when distention of the hypogastrium is noted, prompt intervention is demanded. The author makes an anastomosis between a distended coil of jejunum and the transverse colon and performs a complementary cecostomy. A reflux flow of intestinal contents then occurs from the transverse colon along the ascendens to the cecostomy. Within twenty-four hours there is a free flow and the abdomen becomes flat.

Shipley (76) in discussing deaths from peritonitis refers to drainage as a "necessary evil," and shows how in the course of his experience the number of cases drained has gradually diminished. In cases with early diffuse peritonitis (pus present in the peritoneal cavity, chiefly in the neighborhood of the appendix, but tending to collect in the pelvis and subhepatic region; the gut bathed in pus but still smooth, and no adhesions present; and the patient presenting the clinical picture of acute appendicitis but with little evidence of peritonitis) he urges prompt operation with removal of the appendix and no drainage. In the late neglected cases with a palpable mass, drainage (with appendectomy if possible) is advised, and the rest of the peritoneal cavity is to be disturbed as little as possible. In his article he states the differences of opinion of various authors regarding early and late operations, but takes no definite stand. He gives the impression of favoring prompt operation, however.

Gile and Bowler (26) distinguish between early peritonitis and diffuse peritonitis. In the former, they advise early operation since it may prevent the latter, which has a much higher mortality.

Hertzler (32), in a discussion of different types of appendicitis and the type of peritonitis associated with them, states that it is the necrotic appendicitis and the gangrenous appendicitis which are responsible for spreading or diffuse peritonitis. He advises prompt operation with appendectomy for removal of the cause of the trouble and urges the surgeon to drain "wisely."

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SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Luccioni, F., and Thomas, N.: Internal Strangulation Through the Greater Omentum (L'étranglement interne à travers le grand épiploon). *J. de chir.*, 1938, 53: 331.

According to the authors the literature contains only 35 reports of cases of herniation of the bowel through an orifice in an otherwise normal, normally-placed greater omentum. This rare anatomical defect is usually found singly; infrequently there are two or more rents in the membrane. The opening may be from 1 to several centimeters in diameter and its edges may be thin, as is the case after a fresh mechanical rupture, or they may be thickened and adherent to parietes or intestines if the defect is the site of a chronic inflammatory process. If the latter is the case, the orifice presents a setting especially adapted to the strangulation of a loop of small bowel. Because of its long mesentery, its peristaltic movement, its small size, and its freedom of movement in the abdominal cavity, the small bowel is almost invariably found to be strangulated in such an opening. Only 1 case of colonic strangulation has been reported.

Three types of "transepiploic" hernias may be distinguished: (1) the intestine passes through an orifice of the omentum already contained in the sac of an umbilical, inguinal, or femoral hernia; (2) the intestine gains access through an operative defect of the omentum, as after an anterior gastro-enterostomy; (3) the intestine passes through a thinned-out area of a normal omentum. Such strangulations may be caused by the increase of intra-abdominal pressure, as in defecation, micturition, and parturition.

The symptoms are those of a subacute mechanical intestinal obstruction, with gradually increasing pain, vomiting becoming fecal, distention, fluid collection in the flanks, and other common signs of ileus, together with an increase in the fever and pulse rate, and, finally, oliguria. Unless the diagnosis is made and surgical intervention is resorted to early, these patients usually die of generalized peritonitis following a gangrenous slough of the trapped coil of intestine. Unfortunately the diagnosis is frequently *not* made, and surgical relief arrives too late or not at all. JOHN MARTIN, M.D.

GASTRO-INTESTINAL TRACT

Mitchell, G. A. G.: The Nerve Supply of the Gastro-Esophageal Junction. *Brit. J. Surg.*, 1938, 26: 333.

This study on the nerve supply of the gastro-esophageal junction explains why the results obtained either by sympathetic section or parasympathetic section in the human being have not only been inconsistent, but often diametrically opposite to those theoretically anticipated. Mitchell demonstrated that the lower end of the esophagus has sympathetic enervation from: (1) the gangliated trunks between the sixth and ninth or tenth thoracic ganglia; (2) the greater, and occasionally the lesser, thoracic splanchnic nerves; (3) the para-aortic nerve when present; and (4) the plexuses around the left gastric and inferior phrenic arteries. In addition he found that the thoracic, cardiac, pulmonary, aortic, and esophageal branches from the gangliated trunk were united by vertical filaments in practically linear series.

The para-sympathetic supply is derived entirely from the vagi. After the vagi divide into from two to four main branches lying in close relationship to the lower esophagus there are commonly found three on the right side and two on the left, *all interconnected by finer twigs so that a circumesophageal plexus results.* The right group of vagal fibers eventually lie on the posterior surface of the esophagus, and the left on the anterior surface, but one or two small branches from the right vagus join the anterior half and the left vagus contributes a branch or branches to the posterior half of the plexus. Immediately above the diaphragm or just within the esophageal hiatus the branches of the plexus reunite into one or two main trunks entering the abdomen.

The sympathetic supply to the upper end of the stomach is derived mainly from the celiac plexus, but a small number of sympathetic fibers may come from the esophageal plexus. In a few cases some filaments from the left greater splanchnic nerve or from the upper end of the left lumbar gangliated trunk go directly to the gastro-esophageal junction. Most of the sympathetic nerve fibers from the celiac plexus reach the cardia alongside of the left gastric, the inferior phrenic, and the hepatic arteries. The left gastric branches, varying from 1 to 4 in number, lie near the artery. The left inferior phrenic plexus gives off 1 or 2 branches directly to the cardiac orifice, one of which usually passes to the right and unites with a twig from the plexus accompanying the left gastric artery, or with a branch to the cardia from the hepatic plexus and forms a loop around the junction of the stomach and esophagus. The situation is still further complicated by the fact that other sympathetic pathways come from the hepatic plexus between the two layers of the lesser omentum and send filaments toward the cardiac orifice. *It is important to know that this nerve in most of its course is not near the left gastric artery, although it always comes into relationship with its esophageal branches.*

The parasympathetic supply of the upper end of the stomach consists largely of an anterior trunk which may be single or double and which divides near the proximal end of the lesser curvature into

the hepatic, pyloric, and celiac branches which cross between the layers of the lesser omentum and then pass upward or downward to their destinations. This trunk also divides into a group of gastric branches, some of which radiate to the cardiac orifice and across the fundus and to the upper part of the body of the stomach with one or two larger divisions present along the lesser curvature. The posterior vagal trunk or trunks also divide into two main sets of branches; the smaller group is distributed to the cardiac orifice and stomach somewhat similarly to the anterior group, but the larger part of the nerve continues downward to the right near the left gastric artery and ultimately terminates in the celiac plexus.

The arrangement of the nerve supply to the gastro-esophageal junction has become surgically important since Knight in 1935 suggested a method of sympathectomy for the relief of achalasia of the cardia and cardiospasm. His procedure, consisting of excision of the left gastric artery with its surrounding fatty and nervous tissue, has proved unsatisfactory except in a few cases. These failures can be readily explained because:

1. The sympathetic nerve supply to the gastro-esophageal junction in man comes from several sources which differ from case to case in relative importance, and removal of the left gastric artery with its surrounding fatty and nervous tissues will not completely destroy the sympathetic nerve supply to the junction.

2. The nerve structures in relationship to the left gastric artery are entirely different within a comparatively circumscribed area near the cardia.

3. Widespread removal of the left gastric artery as suggested by Knight might produce the opposite effect to that intended, namely, a complete or almost complete interruption of the parasympathetic supply, and only subtotal sympathetic denervation may result. Thus the patient's condition might be aggravated rather than alleviated. Therefore, the problem of how to best produce sympathetic denervation of the cardiac orifice while doing as little damage as possible to other nerve structures still remains. At once it may be said that any successful peripheral operation would of necessity be more radical than the procedure at present in vogue because the gastro-esophageal junction receives nerve filaments from widely different sources which vary from case to case in relative size and importance. At present, if any peripheral operation is considered it would probably be advisable to remove only the middle and proximal parts of the left gastric artery together with the surrounding fatty and nervous tissues. This would avoid damage to the esophageal and gastric branches of the vagi and would prove as effective as the more radical operation in destroying the sympathetic filaments. It would also be advisable to remove part of the left inferior phrenic artery with its associated nerves and to divide any nerve filaments passing across to the cardia from the hepatic plexus high up between the layers of the lesser omentum, or an attempt could be made to interrupt the nerve fibers to the lower esophagus where they lie in the gangliated trunk or rami. Removal of the gangliated trunks between the sixth and ninth thoracic ganglion may interrupt the sympathetic nerve supply to the cardiac orifice. It is, however, impossible to be dogmatic for many of the efferent fibers might be conveyed in the greater splanchnic nerves, which often have their roots of origin above the level of the sixth thoracic ganglion, and there must be a limit to the extent of operative interference lest the remedy be more dangerous than the disease.

SAMUEL J. FOGELSON, M.D.

Chaffin, L.: Smooth Muscle Tumors of the Stomach. *West. J. Surg., Obst. & Gynec.*, 1938, 46: 513.

The author reviewed the literature on smooth muscle tumors of the stomach and found 363 cases of leiomyoma, which amounted to approximately 77 per cent of all the cases reported; the remainder (33 per cent) were found to be leiomyosarcoma. To these he adds a case of leiomyosarcoma of his own. The distribution between the sexes was nearly equal; 57 per cent of the patients were female and 43 per cent were male. Malignancy occurred in 37 per cent of the males and in only 24 per cent of the females. The ages ranged from seven to ninety years, with the greatest incidence occurring from the fourth to the seventh decade. Malignancy was more frequent in the lower-age group.

The highest incidence of lesions was at the pylorus, with a slightly lower incidence at the cardia of the stomach. Very few tumors of the fundus were found. The greater and lesser curvatures were involved about equally.

The most common complaints included a palpable abdominal mass, epigastric pain, vomiting of blood, tarry stools, persistent vomiting, and indigestion. Many of the tumors found at autopsy were asymptomatic. The duration of the symptoms varied from a few days to forty years. In half of the cases the symptoms had existed for two years or less; in 3 per cent they had been present less than six months.

Physical examination usually yielded no definite diagnostic information except when a mass could be palpated. X-ray examination was of great aid but not without an appreciable degree of error. Of 55 smooth-muscle tumors of the stomach studied roentgenologically, 56 per cent showed evidence of a gastric tumor, 11 per cent showed an extrinsic gastric lesion, and 27 per cent showed a peptic ulcer without a filling defect. Subserous tumors were the greatest source of error in the diagnosis of tumors outside of the stomach. The percentage of error by the roentgenologist has decreased in recent years.

The most common pre-operative diagnosis was carcinoma of the stomach (47 per cent) and nonmalignant tumor (30 per cent). In the lesions diagnosed as extragastric, practically every abdominal and pelvic organ was involved; retroperitoneal tumors were also included.

Of the benign tumors, 63 per cent were operated upon. The type of operation ranged from excision of the tumor to gastric resection. Of the leiomyosarcomas 85 per cent came to operation, which ranged from biopsy to gastric resection. Several patients were operated upon in two or more stages. There were 7 deaths among 105 patients operated upon for benign tumors and 20 deaths among 44 patients operated upon for malignancy. Among the unoperated cases, gastric hemorrhage was responsible for one-half of the deaths. In the remainder of the unoperated cases death resulted from anemia secondary to repeated small hemorrhages, cachexia, or suppuration of the necrotic mass.

Mere excision of the tumor gave as good end-results as extensive gastric resection, and carried a lower operative mortality. EARL O. LATIMER, M.D.

La Manna, S.: Gastro-Intestinal Carcinoids (I carcinoidi gastro-intestinali). *Tumori*, 1938, 24: 381.

The histogenesis of gastro-intestinal carcinoids is still under discussion. The tumors are found most frequently in the jejunum and ileum; those of the ileum show a predilection for adults of the male sex and those of the appendix for the female sex. They may be numerous, and their size varies from that of a pinhead to that of a cherry; they are round or umbilicated, hard, and have a large base of attachment. One of their principal characteristics is the presence of argentochromophil granules in the cytoplasm of their cells, analogous to those found in the yellow cells of the intestine. Other cellular inclusions of carcinoids are droplets of neutral fat and birefractive crystals of lipoid, and occasionally granules of glycogen. The stroma of the tumors is formed by a connective tissue, moderately rich in cells, which are for the most part fusiform; in addition there are lymphocytes, polymorphous leucocytes, plasma cells, and eventually muscular-fiber cells. The blood vessels may be scarce or abundant. Carcinoids are found at autopsy or at operation; in the latter case they are found usually in the appendix They very seldom cause intestinal symptoms, grow slowly, and, when left undisturbed, may undergo malignant degeneration; however, they are usually benign and metastases are rare, as only about 30 cases have been reported.

La Manna describes the case of a woman aged sixty-seven years, in whom about 70 tumors, the size of a small nut, were found. Thirty-one of these, considered primary, were located near the mesenteric insertion, and infiltrated the three layers of the intestine; 28 were observed in the jejunum and ileum, and 3 in the cecum and colon. In some tumors of this group, the tunica propria was little infiltrated and some adenomatous branches issued singly from the bottom of individual crypts of Lieberkuehn, which gave the impression of a multicentric development of the tumor; the newly formed tubules perforated the muscularis mucosæ and continued into the tumor above it. In other tumors of this group, there was no connection with the intestinal glands, and the tunica propria appeared to be intact. There were 40 metastatic nodules, larger than the primary lesions and located in the mesenteric insertion of the intestine, the epiploic appendices, and the mesenterium. The histological morphology of the neoplastic tissue was that of a pure adenocarcinoid in all the nodules, excepting 2 in which was found a microscopic nodule formed of solid cellular cords. The outstanding characteristic of the tumoral cells was the presence of very fine argentophil and lipoid granules. The interest of the case lies in the observation of primary nodules in the cecum and ascending colon, in which no form of carcinoid has as yet been reported, and in the decidedly adenomatous structure of the nodules.

RICHARD KEMEL, M.D.

Wise, R. A.: The Miller-Abbott Double Lumen Tube in Intestinal Obstruction. A Preliminary Report. *Am. J. Surg.*, 1938, 41: 412.

The treatment of intestinal obstruction, whether paralytic or mechanical, is often a difficult problem for the surgeon. Patients with obstruction of long standing who are seriously ill from dehydration and toxemia, will not stand exploration very well, while simple enterostomy frequently fails to alleviate the condition. Any new method which may aid in the treatment of these difficult cases should be welcome. Such a method is described, and the results obtained have been most striking.

The method involves the use of a double lumen rubber tube, like that first devised by Miller and Abbott. These men utilized the tube in a study of the secretion and absorption of the normal small bowel. Ravdin first suggested its use in the treatment and diagnosis of intestinal obstruction.

The Miller-Abbott tube is 10 ft. in length and 16 French in diameter. A rubber septum extends throughout its length, and makes a double lumen tube. The inflation tube opens into a soft rubber balloon; the suction tube has several openings at its distal end and terminates in a metal tip. When the tube has passed the pylorus and the balloon is inflated, it will be carried along by peristalsis through the entire length of the intestinal tract. As it traverses the intestinal tract, suction is applied to remove fluid and gas from each distended loop of bowel. With this tube it is possible to deflate the entire intestinal tract in patients with intestinal obstruction from whatever cause—mechanical or paralytic.

The author describes the technique of use of this tube, as follows:

The end of the tube is well lubricated with glycerin and is passed through the pharynx, by way of the nostril, into the stomach. A swallow of water is given to aid in the passage of the tube, which is introduced until the 75 cm. mark is reached. The patient is placed on his right side, and this position is maintained for from two to six hours, during which time the tip of the tube has usually passed through the pylorus and into the duodenum. This position

may be determined accurately with the x-rays, and some indication of the position may be determined by the syringe test and by the character of the aspirated fluid. With the tube in the duodenum, 30 c.cm. of air are now injected into the balloon; the balloon tube is clamped and constant Wangensteen suction is applied to the suction tube. Every six hours, more of the tube is inserted, until the 8 ft. mark is reached. The suction tube is irrigated once every hour with 20 c.cm. of water.

Three cases of intestinal obstruction are reported:

CASE 1. A man of fifty-four years was admitted to the Bellevue Hospital, New York, with a fracture of the upper third of the left femur. Two days after admission abdominal distention, pain, vomiting, and paralytic ileus developed. This was not relieved by Wangensteen suction and other local measures. A flat plate of the abdomen revealed distended loops of the small bowel. The tube was passed through the duodenum, the balloon inflated, and constant Wangensteen suction applied to the suction half of the tube. At twenty-four hours, the tube end was far down in the ileum. The general condition was greatly improved and 1,000 c.cm. of fecal fluid had drained through the suction tube. By the second day the tube tip had entered the cecum. The abdomen was soft and the patient was able to take cereal, milk, and broth by mouth. He also had a liquid bowel movement. Improvement continued, and on the fifth day the tube was removed from the nostril. There was no recurrence of the distention and the patient had no further trouble.

CASE 2. A man of fifty-eight years was admitted to the Knickerbocker Hospital, New York; he had abdominal pains, a slowly distending abdomen, and persistent vomiting of bile-stained fluids. The symptoms had been present for seven days. In spite of catharsis, the bowels had not moved for one week. The patient was very obese. Physical examination revealed a markedly distended abdomen, with a small umbilical hernia 4 cm. in diameter. Conservative measures were instituted and enemas, high colonic irrigations, and a Levine tube with Wangensteen suction did not relieve the obstructive symptoms. He was given repeated infusions and vomited 1,000 c.cm. of fecal fluid the second day. The Miller-Abbott tube was introduced and within two hours had passed into the duodenum. Constant Wangensteen suction was applied to the suction tube. The first day the abdomen was softer and the patient was taking fluids by mouth, with no vomiting. The drainage amounted to 3,000 c.cm. of fecal fluid. A roentgenogram of the abdomen taken after 50 c.cm. of barium had been injected through the suction tube showed obstruction and a distended loop of small bowel proximal to it. The tip of the tube had passed into the left lower abdominal quadrant. The barium was sucked out of the tube immediately after the roentgenogram had been made. There was steady improvement throughout the next few days, but the tube remained in the same relative position in the left lower quadrant. On the fifth and sixth days, the tube was clamped for twelve hours, and the patient was taking a soft diet with no return of distention and with daily bowel movements. The tube was removed on the eighth day and the patient made a rapid, uneventful recovery.

CASE 3. A young woman of thirty years was admitted to the New York Hospital on February 19, 1938, complaining of repeated attacks of abdominal pain, nausea, and vomiting. She had had 3 previous operations, and an attack of postoperative ileus following the third operation, which was relieved by jejunostomy. Since this patient was known to be subject to the formation of adhesions with intestinal obstruction, it was decided that she now had a partial obstruction, but the site could not be determined. The Miller-Abbott tube was passed through the duodenum within two hours. After twenty-four hours, the tube was introduced to the 7 ft. mark, and a second roentgenogram was made. This revealed the tip of the tube to be stopped in the right lower quadrant, while the barium advanced upward and then downward at a very acute angle. On February 24, 1938, exploratory laparotomy revealed a loop of ileum firmly adherent to the parietal peritoneum in the right lower quadrant. The bowel was sharply kinked, which caused a partial obstruction. The kinked loop of ileum was carefully freed to overcome the obstruction. Convalescence was uneventful. JOHN W. NUZUM, M.D.

Bargen, J. A., Jackman, R. J., and Kerr, J. G.: Studies on the Life Histories of Patients with Chronic Ulcerative Colitis (Thrombo-Ulcerative Colitis), with Some Suggestions for Treatment. *Ann. Int. Med.*, 1938, 12: 339.

This study is based on the records of 871 patients who presented typical clinical, proctoscopic, and roentgenological evidence of chronic ulcerative colitis of the streptococcal type. The most common predisposing factors, and factors influencing relapses of the disease are upper respiratory infection, diseases of childhood, dietary indiscretion, physical and mental fatigue, rectal and abdominal surgical operations, trauma, drastic catharsis, foci of infection with sepsis, exposure, dysentery epidemics, and pregnancy. Of these, upper respiratory infection is the most frequent.

The disease may begin (1) with passage of one or more bloody rectal discharges, without other apparent symptoms (insidious, 444 cases), (2) with sudden, severe, bloody dysentery, but otherwise without symptoms of sepsis and toxemia (severe, 264 cases), or (3) with violent, bloody, purulent dysentery, with septic type of fever, great toxemia, and rapid depletion (fulminating, 163 cases).

On the basis of its course, the disease can be divided into the following types: (1) mild throughout (157 cases), (2) intermittent with declining severity (139 cases), (3) septic with complete recovery (44 cases), (4) constant without remission (69 cases), (5) slowly progressive without remission (143 cases), (6) intermittent with progressive severity (246

cases), (7) insidious onset with slow progression, changing to a fulminating condition and ending fatally (52 cases), and (8) fulminating throughout, ending fatally (21 cases).

Of the 871 patients, 491 were male and 380 female. The age of 32 patients at the onset of the condition was from less than one year to nine years; of 151, from ten to nineteen years; of 316, from twenty to twenty-nine years; and of 372, from thirty to seventy-four years. Although the disease may begin at any time of the year, the number of patients whose symptoms began in January or February was 38 per cent above the expected number, whereas the incidence for June and October was 31 per cent below the expected.

The most frequent complications and sequelæ were polyposis (141 cases), stricture (98 cases), perianal abscess or fistula (73 cases), arthritis (55 cases), and carcinoma (28 cases). Forty-two per cent of the males and 40 per cent of the females had complications.

Treatment includes the administration of antistreptococcal serums and vaccines; a diet rich in calories, high in proteins, and low in residue; frequently a series of transfusions of small amounts of blood; removal of the foci of infection; good nursing; adequate rest of the bowel; and other symptomatic measures. In most cases, drugs are of little help. Surgical intervention should be limited to the complications and sequelæ.

The end-results of this infection may be devastating but they may also be complete relief of all symptoms and signs of intestinal pathological change. The latter occur frequently enough to make it urgent that a well ordered regimen be followed without deviation by the patients for months and years.

Wood, F. G., and Wilkinson, M. C.: Hyperplastic Tuberculosis of the Cecum: Roentgenological Diagnosis. *Lancet*, 1938, 235: 560.

Six cases of hyperplastic tuberculosis of the cecum are described. The chief initial symptom in each case was diarrhea. Colicky pain was also a pronounced symptom, and there was progressive loss of weight and a slight fever. On examination, a slight tenderness was noted in the right iliac fossa, and a slightly movable tumor could be palpated. As the disease progressed a localized peritonitis developed, and in one patient the tumor became fixed in the midline below the umbilicus. Neighboring coils of small intestine became adherent to the mass and, finally, sinuses and fecal fistulas developed. The condition of the patient gradually became worse. No tuberculous lesions developed in other parts of the body in any of the patients.

The differential diagnosis is often difficult, both clinically and roentgenologically. The conditions which may cause a palpable tumor in the region of the cecum are carcinoma of the cecum, hyperplastic tuberculosis, and regional ileitis.

In the series of cases reported, the barium meal was used for roentgenographic examination. This method has the advantages of outlining the cecum (the part of the bowel most often affected), and also the appendix, unless it is occluded by the presence of disease. Serial roentgenograms should be taken three hours after the ingestion of the meal and continued until the cecum and ascending colon are empty. The presence of the constant deformity can be confirmed by means of a barium enema. The appearance of the lesion on the roentgenogram is that of a tumor of the large bowel, but it is not always possible to distinguish roentgenologically between hyperplastic tuberculosis and neoplasm. The appendix was not filled in any of the authors' cases, and it appears probable that this feature may sometimes help in the differential diagnosis. When the appendix does fill, a neoplasm may be suspected.

The roentgenological appearance of regional ileitis may closely resemble hypertrophic tuberculosis if the cecum is affected, but the authors have not observed Kantor's string sign, nor has the obstruction been sufficient to produce multiple fluid levels in a roentgenogram of the abdomen without barium.

The authors conclude that it is often necessary to resort to laparotomy to establish the nature of a cecal lesion. Constitutional measures were successful in some of the reported cases of hyperplastic tuberculosis of the cecum. Nevertheless, surgical treatment should always be considered, and not be delayed until the later stages of the disease when fistulas have formed. JOHN H. GARLOCK, M.D.

Moore, T.: Carcinoid Tumors of the Appendix. *Brit. J. Surg.*, 1938, 26: 303.

Most of the reported early cases of carcinoma of the appendix were undoubtedly examples of metastases which had spread by way of the celom from some primary intraperitoneal site. The early writers stressed the association of the disease with "obliterative appendicitis." They noted that these tumors did not infiltrate widely, nor give rise to metastases in the lymph glands. In 1907, Oberndorfer clarified the position. He showed that there occurred in the gastro-intestinal tract, in addition to the ordinary adenocarcinoma, a superficially related type of tumor, for which he coined the term "carcinoid." This tumor he believed was characterized by its localized nature and apparent benignity, by the absence of mesenteric spread through lymph and vascular channels, by the fact that it was often multiple, and by its distinctive histological appearance.

It is now well known that carcinoids may occur anywhere in the gastro-intestinal tract, from the cardia to the lower end of the rectum. They occur most commonly in the appendix, and they constitute approximately 0.4 per cent of appendicular lesions. They are the most common neoplasm occurring in the appendix. Reimann found 17 appendicular neoplasms in 13,151 appendices removed at operation. Fourteen of these were carcinoid tumors and 3 were adenocarcinomas.

A nodule of characteristic yellow color and of varying size is found in the mucosa. It is of firm rub-

bery consistency and may extend through the mucosa and muscle to involve the peritoneal coat. As the tumor enlarges, it comes in contact with the opposite wall of the appendix and causes obliteration of the lumen. It may occur as an annular thickening of the appendix wall, or the lesion may be so small that it is discovered only upon microscopic examination. The tip of the appendix is most commonly affected. The tumor is three times more common in the female than in the male. Seventy per cent of the patients, at operation, were below thirty years of age.

Although the main feature stressed for carcinoids is their benignity, it is now conceded that an occasional malignant change may occur. Thus Cooke, in 1931, reported that 20 per cent of all carcinoids were malignant, but appendicular carcinoids are very rarely malignant. Microscopically, the tumor is seen to consist of clumps and masses of large spheroidal cells lying in a fibrous stroma in which there may occur a good proportion of involuntary muscle fibers. The cells have round distinct nuclei, but in the larger cell masses the cytoplasmic borders are often ill defined. They bear no resemblance to the ordinary columnar or mucus cells lining the gastro-intestinal tract. It is generally believed that the Kultschitzky cells are the site of origin of carcinoid tumors. Thus they would be more accurately termed "argentaffinomas," but the adjective "carcinoid" appears to be more deeply rooted in medical nomenclature.

The disease has never been diagnosed before operation or autopsy. It may be responsible for an acute attack of obstructive appendicitis. In cases without marked obstruction, a mucocele may result. Very rarely is there extension of the tumor. Only 1 case with metastases to the liver has been reported. The tumor is clinically benign and the results of simple appendectomy are excellent. Should extensive glandular involvement occur, a classical excision of the right colon together with the involved glands will give an excellent postoperative result.

Three years ago, the author encountered 2 cases of obstructive appendicitis due to carcinoids. A search of the records of the Royal Victoria Infirmary, Newcastle-on-Tyne, during the ten-year period from 1927 to 1936, revealed 10 additional cases which are briefly summarized. JOHN W. NUZUM, M.D.

Daniels, E. A.: Prolapse of the Rectum. *New Internat. Clin.*, 1938, 4: 202.

Prolapse of the rectum may be defined as a loosening and unnatural freeing of the rectal mucosa or muscularis, or both. In this condition the supporting structures of the rectum are all abnormally relaxed which permits the extrusion of this terminal portion of the bowel through the anal orifice. Rectal prolapse occurs in two main degrees: (a) prolapse of a superfluous redundant mucous membrane, and (b) prolapse of the muscle coats of the rectum. In the mucous-membrane variety of rectal prolapse, the protrusion is smooth and easily sucked back into the bowel lumen. Complete prolapse presents itself as a large thick mass and has an apex at its lowest extremity. Reduction is not easily effected as is the case in mucosal prolapse.

The factors which cause prolapse of the mucous membrane of the rectum are quite different from those which come into play in the development of complete rectal prolapse. The mucosa of the lower rectum is normally very loosely attached to the submucosa with fibrous and elastic tissue. This loose attachment leads to redundancy which is especially evident on the anterior and lateral walls of the lower rectum. If the anal orifice permits, this redundant, superfluous mucous membrane may be extruded and the condition known as mucous-membrane prolapse becomes established. The patient may be conscious of a feeling of fullness as if a foreign body were present in the rectum. The writer uses the name of "concealed mucous-membrane prolapse" for this variety of lesion. Backache may be a frequent complaint. Constipation is a common occurrence since this redundancy fills the lower rectum and precedes the stool. Such individuals frequently develop a low-grade proctitis with anal fissures and pruritis. There may be a mucopurulent discharge.

In the type of individual in whom the anal canal is not tubular but short, stout, and patulous, a mucosal redundancy will be easily extruded. Prolapse of the rectum in children may present itself as a mucous-membrane type or as a complete prolapse including the muscle coats. The plane of the infant pelvis is rather vertical and the inner surface of the sacrum quite flat. The coccyx possesses very little of a forward tilt and may lie almost in a straight line with the sacrum. The anal orifice has a more posterior position than that seen in adults, and a line drawn from the tip of the coccyx will be found to be almost in a straight line with the anal orifice. It is thus evident that in an infant undue loss of weight, diarrhea, and straining at stool are frequently sufficient to initiate either an incomplete or complete prolapse of the rectum. In the author's cases of complete prolapse of the rectum, the entire rectum descended through the anal orifice. Reduction may be easily effected or it may be impossible. Obstruction of the blood supply through the prolapsed bowel occurs, edema follows, and in severe cases, the lesion may present itself as a large, bluish edematous deeply engorged mass with superficial areas of necrosis on the surface of the lesion.

Obviously one cannot reconstruct the pelvis nor remove all of the predisposing factors operative in the production of rectal prolapse. It is essential that the operator determine whether the lesion is a mucous-membrane prolapse or whether he is dealing with a complete prolapse. The author bases his opinions on experience gained in the treatment of 22 cases of complete rectal prolapse and more than 50 cases of incomplete mucous-membrane prolapse. The plan of treatment consisted in obliteration of the redundant, superfluous mucous membrane with a sclerosing solution; fixation of the rectum in the

pelvis (this organ is surrounded with an area of dense inflammatory scar tissue by means of a sclerosing solution); repair and reinforcement of the anorectal sphincteric musculature; and, finally, perineorrhaphy in both males and females to supplement the first three procedures. In this series of patients, conservative measures sufficed either to completely correct the disturbance in the majority of the patients or to give sufficient relief to make the patient's life agreeable. The author has never had to carry out the operation of rectosigmoidectomy. However, this very radical operation has a definite place in dealing with the intractable type of prolapse.

JOHN W. NUZUM, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Gray, S. H., Probstein, J. G., and Heifetz, C. J.: Transient Acute Pancreatitis. *Ann. Surg.*, 1938, 108: 1029.

Twenty-one cases which have finally been labeled transient acute pancreatitis are presented in detail.

The clinical signs and symptoms upon which this diagnosis is based are sudden severe upper abdominal pain radiating through to the back or to the shoulder; nausea and vomiting may or may not be present; and shock may be demonstrable. Examination usually reveals marked tenderness of the upper abdomen and rigidity of varying degrees. Early in the attack the temperature is usually normal, but it may be elevated later. The leucocyte count is usually high.

The blood and urinary diastase were determined by Somogyi's method. Normal blood diastase values ranged between 80 and 180. The rise of diastase in the blood was possibly due to a combination of factors, namely, inflammatory or spastic occlusion through the duct system and interstitial absorption of diastase. Liver and muscle tissue must also be considered as possible additional sources of circulating diastase. Following a rise in the blood diastase, there results in from two to five hours a corresponding rise in urinary diastase unless there is an impairment of the kidney function.

The sudden marked rise of blood diastase associated with acute pancreatic disease is highly significant. The authors believe that repeated normal blood-diastase determinations made early during an attack of acute upper abdominal pain exclude the pancreas from consideration. To use the diastase determinations one must be careful to make early and repeated examinations. With regard to the use of blood-diastase versus urine-diastase determinations, it would be preferable to use both. Normal blood diastase fluctuates less widely than normal urine diastase. Urine diastase varies between 200 and 800 and shows considerable irregular diurnal variations. Since the urine diastase follows fluctuations in the blood after a lapse of several hours, urine diastase determinations may furnish valuable information if they are made during the subsidence of an attack. Thus urine diastase may remain elevated after the blood diastase returns to normal. There seems to be no constant relation between the severity of an attack and the level of a diastatic activity.

At least half of the authors' cases presented unmistakable signs of biliary-tract disease. Biliary-tract disease *per se* is not accompanied by an elevated blood diastase; on the contrary, *many cases of biliary-tract disease when associated with impaired liver function present subnormal blood-diastase values.* When a patient with biliary-tract disease suddenly develops an elevated blood diastase the presence of a pancreatic involvement should be suspected.

Many cases of acute pancreatitis occur without glycosuria. A blood-sugar determination may add weight to the diagnostic conclusions.

The first examination will most likely not distinguish between a pancreatitis of the transient type and one which will progress to necrosis with its accompanying high mortality. The authors are of the opinion that until more specific measures are forthcoming to combat acute pancreatic disease, the best results will be obtained by conservative management of all cases. This applies not only to lesions of a transient nature but also to the more severe lesions of hemorrhage, suppuration, and necrosis. If, on operation, evidence of acute pancreatic involvement is found immediate closure of the abdomen without further interference is recommended, and eradication of the biliary-tract disease should be delayed until the acute attack of pancreatitis has completely subsided.

RICHARD J. BENNETT, JR., M.D.

Graham, H. F., and Hoefle, M. E.: Acute Cholecystitis. *Ann. Surg.*, 1938, 108: 874.

The authors review the literature with regard to the mortality rate of operations for acute cholecystitis carried out within forty-eight hours of the onset of the condition. There was a mortality rate of 3.59 per cent for 167 cases of acute cholecystitis operated upon within this time.

The authors discuss the difficulty of cholecystectomy for acute cholecystitis. They recommend that the gall bladder be aspirated and that it be removed from above downward. The bleeding of the liver bed may be controlled by pressure with a gauze pad and a retractor. To avoid the possibility of severance of the cystic duct, they recommend that the duct be ligated with traction toward the common duct instead of away from it. Excessive bleeding may be controlled by pressure on the hepatic artery until the bleeding vessel has been clamped and ligated. Free omental grafts may be anchored to the liver bed if its obliteration is impossible by the usual methods. The majority of the cultures taken during the first forty-eight hours are sterile.

A review of the literature tends to show that delayed surgical treatment in acute cholecystitis gives a mortality rate of 10 per cent, as compared with 3.5 per cent in cases operated upon within forty-

eight hours. Cases have been reported in which a totally gangrenous gall bladder was found seven hours after the acute onset of pain. The reported incidence of gangrene is about 20 per cent in the majority of series of cases of acute cholecystitis. Since delayed treatment apparently gives a much greater mortality rate, it is urged that operation in acute cholecystitis be carried out within the first day or two after the onset of symptoms.

ROBERT ZOLLINGER, M.D.

Rehfuss, M. E.: The Problems of the Postoperative Gall-Bladder Patient. *Med. Clin. North Am.*, 1938, 22: 1683.

A general discussion is given of the diagnostic problems associated with gall-bladder disease which is not relieved by gall-bladder surgery. The status of the appendix is considered in all cases with persistent digestive symptoms. A study of the right lower quadrant is made also in all such cases. There is a relatively high incidence of peptic ulcer in association with gall-bladder disease, and duodenitis is commonly associated with gall-bladder disease. It is emphasized that removal of the gall-bladder does not necessarily improve the duodenitis or the cholangitis. These conditions require further medical therapy. Abdominal indigestion in middle life requires that malignancy, especially of the stomach, pancreas, and colon, be ruled out. Cholangitis requires further diagnostic measures and treatment by means of the duodenal tube. Surgery is not performed for hepatitis or when the function of the liver is seriously impaired. These disorders may be recognized if appropriate tests of the liver function are carried out. A low-grade pancreatitis is not easily recognized. The surgeon should palpate the pancreas at the time of cholecystectomy for evidence of induration and thickening. The presence of pancreatitis may be recognized by means of appropriate duodenal tests and the pancreatic type of stool.

Satisfactory medical treatment can usually be carried out with appropriate diet. Seventy-five per cent of the patients with gall-bladder disease are constipated and show some signs of colitis or colon dysfunction. About 65 per cent of the patients who have had cholecystectomy as long as ten years previously present the same phenomena. The majority of these cases were of the spastic type. Medical treatment was directed toward the use of sedatives and antispasmodics. A right renal calculus may produce symptoms simulating gall-bladder disease. A miscellaneous group of conditions, such as adhesions, tabetic crises, abdominal angina, coronary-vessel disease, and lead poisoning, must be considered in the differential diagnosis of gall-bladder disease.

Cholecystectomy is justifiable when the function of the gall-bladder is hopelessly compromised.

The author emphasizes that not every case of calculous cholecystitis need be treated by cholecystectomy and that there is an optimum time for gall-bladder surgery. Furthermore, a clinician should remember that removal of the gall bladder with gall stones does not insure healing of the liver and biliary passages. The author believes that it is possible for stones to recur in the common duct.

Medical treatment of cholangitis is given; it consists of an effort to improve function of the colon, to stimulate liver activity, to clear the ducts by the use of the intestinal tube with mineral-water therapy, and of various methods, such as vaccine therapy and filtrate therapy to improve the patient's resistance. Any possible focus of infection is removed.

ROBERT ZOLLINGER, M.D

Gray, H. K., McGowan, J. M., Nettrour, W. S., and Bollman, J. L.: Hepatic Damage in Biliary Disease: Its Relation to the Concentration of Bile Acids in the Bile. *Arch. Surg.*, 1938, 37: 790.

A clinical study was made of 50 cases of biliary disease in which drainage of the common bile duct was established by means of a T-tube. The condition of the liver was estimated from the history, from the results of recognized tests of hepatic function, and from the gross appearance of the liver at operation. The degree of hepatic damage thus determined was correlated with frequent determinations of the concentration of bile acids in the bile.

Low concentrations of bile acids were found in every case in which there was other evidence of hepatic damage. An inhibition of the concentration of bile acids by the liver occurred postoperatively. Recovery from this inhibition was rapid in the cases in which the liver was clinically normal, but in the cases in which the liver had been damaged it was slower. A moderately damaged liver may continue to improve slowly even after a month of T-tube drainage.

MISCELLANEOUS

Payne, R. L.: Spontaneous Rupture of the Superior and Inferior Epigastric Arteries Within the Rectus Abdominis Sheath. *Ann. Surg.*, 1938, 108: 757.

In the presence of spontaneous rupture of the epigastric artery, the patient usually complains of sudden, severe pain in the abdomen, either to the right or left of the midline, and at about the level of the umbilicus. With rapid development of massive hemorrhage, the pain is sometimes severe and there is frequently nausea and vomiting. The temperature is normal or increased; there is a moderate leucocytosis, and often a tender, localized mass of varying size is found to be confined to the sheath of the rectus muscle. One feature of the mass is that it does not change its position and always appears to be fixed to the abdominal wall. Ecchymosis is a most important sign, generally offering the first intimation as to the correct diagnosis. Too frequently the condition has been diagnosed as an acute intra-abdominal lesion.

The history of 3 cases of spontaneous rupture of the epigastric vessels is reviewed.

Possible etiological factors are considered and the literature is summarized. Muscular effort, such as coughing and sneezing, is reported in many cases. The condition has often been found to occur in association with infectious processes, such as tetanus, tuberculosis, typhoid, influenza, and low states of muscular inanition. Degeneration of the blood vessels must also be considered an important contributing factor, for in practically all of the cases reported the individuals were in late middle life, and all showed evidence of sclerosis and vascular degeneration, which was indicated by varying degrees of hypertension. Latent blood dyscrasias, C avitaminosis, and spontaneous rupture due to focal degeneration of the muscle and vessels are considered. Quite an important group are those occurring in pregnancy, during parturition, or soon after delivery.

There is no informative record covering the underlying pathology of this condition. Vascular disturbance followed by hyaline degeneration is the principal pathological lesion associated with the rupture of muscle or vessels within the rectus sheath. The anatomy of the rectus muscle and its blood supply is briefly reviewed.

The impression is almost universal that spontaneous rupture of the epigastric artery is a very rare occurrence. The literature controverts this idea. There have appeared in the last decade 77 articles recording 165 cases of this condition for analysis. Probably twice that number of cases were observed during the same period, but were not reported. Proper treatment consists of early and correct diagnosis, followed by prompt operative evacuation. The principal danger lies in a mistaken diagnosis and procrastination in operation. In a large percentage of delayed operations, infection of the hematoma is superimposed and becomes a grave complication.

HARVEY S. ALLEN, M.D.

Frank, R. T.: Primary Retroperitoneal Tumors. *Surgery*, 1938, 4: 562.

Between the years 1925 and 1936 there were reports in the literature of 107 primary retroperitoneal tumors. The author did not include in his review neoplasms arising specifically from residual urogenital embryonic rests. The majority of the growths were mesodermal in origin (72 per cent), while 18.7 per cent were ectodermal (neurogenic), and 9.3 per cent were teratomas.

The retroperitoneal tumor may vary greatly in size; one tumor, as noted in the literature, weighed 69 pounds. Such tumors may be solid or cystic and, with exception of the round-cell sarcomas, are well encapsulated. Multiple masses, often unconnected, may be present, and the failure to remove all such masses is believed by the author to be responsible for the recurrence of the benign tumors.

Histologically, these tumors fall into the following groups: lipomas, fibromas, cysts, myxomas, sarcomas, neuromas, and teratomas. In the author's series of 107 cases, recurrence was noted in 13 per cent, with metastases in 3.7 per cent, while in an older series metastases occurred in 33 per cent of the cases.

While the clinical symptoms are not characteristic, vague digestive disturbances, an abdominal mass, and loss of weight and strength are the rule. Most often the pre-operative diagnosis is that of fibroids, ovarian cysts, hypernephroma, and tuberculous peritonitis. Gastro-intestinal and renal x-ray studies are of great value, both for exclusion and as a means of locating the tumor.

Operation is the treatment of choice, and it is important that even benign growths be prevented from increasing to great size or death will be the probable outcome. Only 10.1 per cent of the patients seen clinically were inoperable. Radiotherapy combined with surgery or used alone is valuable except in the lipomas and fibromas. The method of approach has been both retroperitoneal and transperitoneal. The operative risk is more closely allied to the histology of the tumor than its size. The mortality rate was 0 for benign tumors, 18.2 per cent for myxomas, 22 per cent for neuromas, 28.1 per cent for sarcomas, and 36.7 per cent for teratomas.

The author adds 3 new cases, the first an embryonic tumor of mesodermal origin, the second a myxoliposarcoma, and the third a retroperitoneal cyst that the author does not consider mesenteric in origin.

EARL O. LATIMER, M.D.

GYNECOLOGY

UTERUS

Gross, G.: The Pathogenesis of Genital Infarcts Due to the Intra-Uterine Injection of a Soap Solution (La pathogénie de l'infarctus génital par injection intra-utérine d'eau savonneuse). *J. de chir.*, 1938, 52: 311.

Gross notes that the occurrence of genital infarcts as a complication of the intra-uterine injection of soap solution is rare in comparison with the frequent employment of such solutions to produce abortion. The pathogenesis of this lesion is doubtful. A number of cases have been reported in which there was an associated infection of the uterus; but in other cases the lesions have been purely vascular with no signs of inflammation or infection. A number of detailed case reports show that all types of soap have been employed in cases in which an infarct has resulted; the injection has sometimes been made by the patient herself and sometimes by the more "brutal" methods of the professional abortionist. Thus, in one of the cases observed by the author in which an infarct resulted, the injection of a 2 per cent solution of dark soft soap had been made without force by the patient herself. In another case in which the patient made an uncomplicated recovery after curettage, an 8 per cent solution of soap had been injected under pressure. As the clinical facts do not throw much light on the pathogenesis of an infarct, the author carried out a series of experimental studies, using various forms of soap.

In pregnant rabbits, the uterus was exteriorized so that the progress of the sound introduced per vaginam could be observed. It was found that this sound often tore the placenta or injured the uterine wall, so that the soap solution injected entered the maternal circulation. The caustic action of the soap was not found to be sufficient to produce the extensive lesions found in a genital infarct. It was found, however, that soap solutions added to defibrinated and washed red cells caused hemolysis and hemolytic thrombosis; this action was most marked with solutions of the highest pH. In carrying out experiments on pregnant rabbits it was found that if the soap solution was injected into the placenta near its point of attachment, it entered the uterine veins and there produced complete thrombosis.

Further experimental studies showed that the soap solution caused a marked vasomotor reaction by irritation of the vascular endothelium which resulted in vascular paralysis, especially of the capillaries. In cases in which a genital infarct resulted from an intra-uterine injection of a soap solution, it was evident that the solution must have reached the maternal circulation; however, in order to produce an abortion it is necessary only that the embryo be perforated. The pregnant uterus is well vascularized and in a state of functional activity; this factor increases the sensitivity of its vessels to vasomotor irritants.

An infarct causes a state of necrosis, which favors the multiplication of micro-organisms and the spread of infection, as is often observed in cases of infarct resulting from the intra-uterine injection of soap solution. The infection is not, however, necessary for the production of the infarct. The author's studies indicate that an infarct is the result of the action of the soap solution on the blood and the blood vessels.

ALICE M. MEYERS.

ADNEXAL AND PERIUTERINE CONDITIONS

Thomson, J. G., and Stabler, F.: Lipoid-Rich Granulosa-Cell Tumor: with a Discussion on Theca-Cell Tumor. *J. Obst. & Gynaec. Brit. Emp.*, 1938, 45: 769.

A case is described in which the patient, a sixty-five-year-old woman, presented herself with a history of periodical bleeding which occurred every two or three months for fourteen days at a time. The menopause had occurred at fifty years of age. In the lower abdomen was a rounded mass reaching to the umbilicus. It was mobile and not tender, softer than a fibroma, but not cystic. The mass was separate from the uterus. The latter was diffusely enlarged. A diagnosis of granulosa-cell tumor was made. At operation, the internal genitalia were removed. Examination of the tissues revealed that the uterus was definitely enlarged for a woman of sixty-five; after fixation it measured 8.3 by 6 by 3.8 cm. The endometrium was very thick and hyperplastic. Microscopically it showed extreme glandular hyperplasia of the secretory type. The stroma was relatively scanty but its cells were plump, oval, and active looking. The right ovary was replaced by a large, rounded, solid tumor measuring 8.5 by 8.7 by 4 cm. The growth was smooth and covered by a thin translucent capsule under which yellow tumor tissue could be seen. The cut surface presented a bright yellow color, quite homogeneous, apart from scanty strands of grayish connective tissue; there was no hemorrhage or degeneration. The growth resembled a gigantic solid corpus luteum. Microscopically, the tumor was very cellular, formed of small cubical cells arranged in columns closely packed together. The general pattern was that of moiré silk. Mitotic figures were infrequent. The growth contained much lipoid, in the form of tiny droplets in practically every tumor cell. Most of the fat was doubly refracting. Chemical analysis of a portion of the tumor revealed that 9.35 per cent of the moist tissue was fatty, 15.8 per cent being free cholesterol, 70.2 per cent cholesterol ester, 12.6 per cent neutral fat, and 1 per cent phospholipin.

Tumors of the ovary with high lipoid content and a yellow color have been described in the literature

under the names of hypernephroma, luteinizing granulosa-cell tumor, and theca-cell tumor. The authors believe that there is no proof of the existence of primary ovarian hypernephromas; moreover the histological structure of the tumor under discussion did not in any way suggest hypernephroma.

Since 1932, some 18 cases of so-called theca-cell tumor of the ovary have been reported. Geist gives the following points of differentiation from a granulosa-cell tumor: (1) the theca-cell tumor is a hard fibrous tumor, while the granulosa-cell tumor is softer and more medullary; (2) it is not like a granulosa-cell tumor, histologically, but is formed of connective-tissue cells and has a much more uniform structure; (3) the lipoid content of granulosa-cell tumors is scanty and mainly extracellular, while in theca-cell tumors it is more abundant, mainly intracellular, and consists of cholesterol and cholesterol esters; and (4) the theca-cell tumor is attended by definite clear-cut symptoms, atypical postmenopausal bleeding, and hyperplasia of the endometrium.

Careful analysis of the 18 reported cases leads the authors to doubt the authenticity of theca-cell tumors as a "clearly defined group." They believe, with Motta, that granulosa-cell tumors are of mesenchymal and not of epithelial origin, and that epithelium-like tumor elements in theca-cell tumors are just as frequent as sarcoma-like elements in granulosa-cell tumors. In other words, they doubt a difference in origin between the 2 tumors. If their opinion is correct, the main point of difference between these tumors is removed. Nor are all of the theca-cell tumors hard and fibrous. Five of 10 such tumors, as reported by Loeffler and Priesel, were soft. Yellow areas of lipoid deposition, while not common in granulosa-cell tumors, have been a marked feature in a number of the cases reported. The statement that the lipoid in theca-cell tumors is mainly cholesterol and its esters, while in granulosa-cell tumors it is phospholipin is also doubted. There are enough reports in the literature of doubly refracting lipoids in granulosa-cell tumors to make this point of differentiation of little value. Even the "clear-cut, definite syndrome" is lacking in many of the cases, the history of bleeding being very variable. On the whole, the authors doubt the existence of a special group of ovarian tumors with the characteristics described.

The histological structure of the tumor reported was typical of a granulosa-cell tumor of the cylindroid type. The moiré silk pattern was well marked and the only unusual feature was the very high lipoid content of the tumor cells. A few reports of lipoid-rich granulosa-cell tumors were found in the literature. Curiously enough, all were of the cylindroid type with the moiré pattern. Hormone studies were not made in this case, but the secretory type of endometrial hyperplasia and the absence of development of the breast are more in favor of an excess of luteal hormone than of estrin. On the other hand, the onset of menopausal symptoms which followed removal of the tumor suggests that estrin was also being produced by the tumor. The authors believe, therefore, that their tumor is an instance of luteinizing granulosa-cell tumor, but until more hormonal evidence is at hand they prefer to give it the non-committal designation of lipoid-rich granulosa-cell tumor.

The patient was free of recurrence twelve months after operation. The gross and microscopic characteristics of the tumor suggested a benign growth. The authors believe that luteinization is of good prognostic significance. DANIEL G. MORTON, M.D.

Chalier, A.: Total Linear Salpingotomy; Technique and Indications (La salpingotomie linéaire totale; technique et indications). *Rev. franç. de gynéc. et d'obst.*, 1938, 33: 577.

In total linear salpingotomy the fallopian tube is opened its entire length, except for the interstitial portion, and spread out flat. As a preliminary step, it must be freed from whatever adhesions may be present, and mobilized. An assistant holds it steady by means of two forceps applied right and left to the distal part of the pavilion. A fine grooved sound is introduced into the tube up to the uterine wall, if possible, and the tube is incised longitudinally along its upper border in order to respect the integrity of the vessels and nerves of the mesosalpinx. In cases in which the pavilion is closed, a nick is made in the ampullary portion to allow introduction of the sound. Any inflammatory nodules or caseous masses are removed with the knife or destroyed with the thermocautery or the galvanocautery, care being taken not to interrupt the continuity of the tube. If a large pocket is found, its most distended portion is resected. If the upper border of the tube has been followed, there will be little bleeding, and this is easily controlled by means of a compress. The spread-out tube is then fixed by one or two points of salpingopexy suture to the parietal peritoneum or to the infundibulo-ovarian ligament. The tube may be protected by a catgut sheet, but this is not indispensable in all cases. The question of drainage depends on the nature of the lesions found. A flat vaselined strip of gauze, folded like an accordion, is recommended for support of the tube below and for cover of its upper part so as to isolate it from the epiploon. Issuing at the level of the pubis, it will not interfere with solid and complete reconstruction of the abdominal wall. In some cases it may be found advisable to evert the tube completely as is done in the operation for hydrocele of the testicle.

The object of this operation is to conserve the diseased tube, to favor its healing, and if possible to obtain restitution to its former condition; the indications will consequently depend on the age of the patient and the nature and degree of the lesions present. Conservation of the tube is justified by the indication to safeguard the ovary whenever possible and by the hope of restoring the function of the tube as oviduct. The best way to safeguard the ovary is to conserve the tube with all the neurovascular con-

nections that unite the two organs and make of them an anatomical and physiological unit which should not be dissociated. Therefore, total linear salpingotomy is indicated in any subacute or chronic salpingitis, no matter of what nature. With the exception of pyosalpinx, this intervention is sufficient to heal the disorder, as proved by the rapid disappearance of the symptoms. It allows restoration of the tube as an oviduct in certain patients, as proved by the case of a previously sterile young woman who was salpingotomized and, forty months later, came under observation for a painful small tumor of the uterus. She had been pregnant for four months. At operation, a fibroma was removed by myomectomy and it was observed that the tubes were free from adhesions and were so perfectly reconstructed that no trace of the former operation could be found.

RICHARD KEMEL, M.D.

EXTERNAL GENITALIA

Hall, W. E. B.: Vaginal Hernia, with a Review of the Literature. *Arch. Surg.*, 1938, 37: 651.

Vaginal hernia is a herniation of the peritoneum pushing downward through the pelvic floor into the vaginal vault, or along the wall between the vagina and the rectum or bladder, sometimes extending all the way to the perineum. This type of hernia represents a subvariety of pelvic hernia, the latter term including all hernias through the pelvic floor. The condition is rare.

An attempt is made to review the literature. The reports indicate a lack of reliable statistical data on vaginal and pelvic hernias because of the multiplicity and uncertainty of terminology and diagnostic requirements, and because of inadequate examinations and reports, and mistaken interpretations. By strict standards, some 26 cases have been reported; by the broader interpretation of accepting the diagnosis of the examining physician, 83 cases have been reported. The author reports a case of his own in which, for the first time, microscopic examination of the involved tissues was made. It was indicated that an aneurysmal relaxation of degenerated tear tissue resulting from obliterative endarteritis occurred, and that this may be expected in senile and arteriosclerotic patients in the absence of traumatic and congenital changes, and act as a contributing factor with them.

Anatomically, vaginal hernia occurs most often in the bottom of the cul-de-sac, the internal ring being formed by the uterosacral ligaments and the anterior rectal wall, or by separated fibers of the pelvic fascia, levator ani muscle, and the cervix. Less frequently it occurs anterior to the cervix. Etiologically, congenital maldevelopment, and defects and variations in the pelvic floor are main predisposing factors. Trauma at birth is of course the chief contributing cause.

Frequently vaginal hernia is not diagnosed at the first examination or operation (e.g., operation for prolapse or rectocele) and must be differentiated from various pelvic and vaginal conditions, particularly rectocele, cystocele, and prolapse of the uterus. It must also be differentiated from abscess, cyst, hematoma, lipoma, polyp, fibroma, and cysts of Gartner's duct. One should note carefully if the mass is reducible and has a hernial ring at the base.

Usually, vaginal hernia causes discomfort only, but in 1 of 4 cases the condition is complicated. The complications reported were interference with normal delivery, incision or excision due to error in diagnosis, pelvic abscess, rupture with evisceration, death from incarceration. If the condition develops during labor, the signs may be those of shock and intestinal obstruction; the treatment in this case is immediate return of the head, and reduction of the hernia. Obstruction and strangulation from other causes demand immediate surgical intervention.

The treatment is surgical, with an abdominal, a perineal, or a combined approach. The second is usually to be preferred. The vaginal mucosa is incised longitudinally over the mass and the sac is carefully exposed by blunt dissection. If an intestinal loop is in the sac, the patient's hips are elevated to effect reduction. The sac should be opened with the greatest care and cut short, and the stump sutured behind the cervix, or, the sac may be sutured whole to the uterine surface as an additional support to the pelvic floor. The pelvic floor is then closed by cross or purse-string sutures, after which perineovaginal defects are corrected, excess vaginal tissue is trimmed off, and the operative wound closed. All factors which cause increased intra-abdominal pressure, such as obesity and tumors, should be corrected by appropriate prophylactic surgical and medical procedures.

DANIEL G. MORTON, M.D.

OBSTETRICS

LABOR AND ITS COMPLICATIONS

Motta, G.: Causes for the Greater Resistance of the Lower than of the Upper Hysterotomy Scar. Silent Rupture of the Lower Hysterotomy Scar During Labor (Sulle cause di maggiore resistenza della cicatrice isterotomica segmentaria rispetto a quella corporea. Rottura silenziosa di cicatrice isterotomica segmentaria in travaglio di parto). *Arch. di ostet. e ginec.*, 1938, 2: 408.

Recent statistics show that rupture of the upper hysterotomy scar during a subsequent pregnancy or labor occurs in 2 per cent of the cases and that the adoption of suprasymphyseal hysterotomy has notably reduced the incidence of rupture to 0.28 per cent; however, on anatomical and physiological grounds it would seem reasonable to expect an increase in the frequency of rupture after hysterotomy of the lower segment. In order to evaluate the conditions that may determine or favor the rupture of a hysterotomy scar, the author describes an unusual case of extensive rupture which occurred in the beginning of a labor subsequent to a low hysterotomy performed one year previously. The rupture was discovered early and remained subperitoneal because of timely surgical intervention. Although the numerous and strong adhesions between the lower uterine segment and the abdominal wall might have contributed to retard complete rupture, this condition would nevertheless have eventually occurred with the progress of labor. The placenta was inserted rather low on the anterior wall of the uterus, partly on the site of the hysterotomy scar. The rupture did not give rise to any symptoms and was discovered only through vigilant obstetrical observation. An important pathogenetic fact in this case was the discovery of markedly defective repair of the previous hysterotomy wound.

The advantages of the low over the high hysterotomy, consisting in less peritoneal trauma, complete covering of the uterine wound with peritoneum, and less frequent rupture of the scar during a subsequent pregnancy or labor, are connected with the life of the patient but not with her health, as there is a decided incidence of healing by second intention or of a febrile puerperium. It is evident that muscular regeneration cannot be better in low than in high hysterotomy and that there must be some other explanation for the rarity of rupture of the lower hysterotomy scar. This explanation is to be found in the site of insertion of the placenta with infiltration of the scar by chorial elements favored by insufficient or incomplete decidual protection at this level; many cases, including the present case, have been reported in which low insertion of the placenta on the site of or close to the hysterotomy scar was present. It has been noted that, of the various types of upper hysterotomy in use, those of the fundus threaten with the greatest danger of rupture during subsequent pregnancy or labor and those of the anterior wall of the uterine body are associated with less danger; on the other hand, the hysterotomy scar of the lower segment of the uterus is only rarely involved by rupture. These findings agree with the relative frequency of insertion of the placenta at these sites and show that the presence of any degree of placenta previa should arouse suspicion of the possibility of rupture when a low hysterotomy has been performed previously. RICHARD KEMEL, M.D.

Manévitch, A. E.: Spontaneous Amputation of the Uterine Cervix During Labor (Amputation spontanée du col de la matrice pendant l'accouchement). *Gynécologie*, 1938, 37: 513.

Manévitch reports the case of a primipara, in whom during the expulsive stage of labor, an oval body of bluish color appeared at the vaginal opening with each uterine contraction. In appearance it was not unlike the scrotum of a male infant in a breech presentation, but examination showed the child to be presenting normally. Vaginal examination revealed that this body was the vaginal portion of the cervix uteri, and that it was almost completely detached from the uterus and the vaginal vault except for a small flap of tissue at the anterior lip. The infant was delivered with forceps; during the manipulation of the forceps, an attendant pushed the detached portion of the cervix up; the child was delivered in good condition without signs of asphyxia; the placenta was expelled spontaneously in ten minutes. After delivery, examination showed the vaginal portion of the cervix to be completely detached, as if severed with a knife, except for a small portion of the anterior lip by which it was suspended; there was no bleeding. The spontaneous amputation was completed by a transverse incision of the tissue at the anterior lip. On the fourth and fifth days of the puerperium, the patient developed some fever (38° C), and there were signs of a mild endometritis, but these symptoms subsided under local treatment and the patient was discharged in good condition.

The patient was a French woman thirty years of age; her development as a child had been somewhat retarded; menstruation had been irregular and scanty; although married four years and having used no contraceptive measures, she had never been pregnant previously. Examination of the amputated cervix showed the opening of the external os to be only 2 cm. in diameter, the walls of the cervix from 15 to 20 mm. in thickness, and the length of the vaginal cervix from 37 to 38 mm. Histological study showed the muscular tissue of the cervix to be incompletely developed, resembling that of a child; the elastic tissue was much diminished in comparison with the normal. The author is of the opinion that the congenital or constitutional rigidity of the cervix

in this woman with a hypoplastic constitution and infantile development was the chief cause of spontaneous rupture of the cervix during labor.

A review of the literature shows that such spontaneous rupture of the cervix is of rare occurrence. It is usually not accompanied by hemorrhage; the chief danger is the formation of a vesicovaginal fistula and septic infection in the puerperium.

ALICE M. MEYERS.

Courtois, J., and Bouchacourt, C.: A Report on 158 Cases of Low Cesarean Section; Indications and Results (A propos de 158 cas de césarienne basse; indications et résultats). *Rev. franç. de gynéc. et d'obst.*, 1938, 33: 790.

Courtois and Bouchacourt report 158 cases in which low cesarean section was done in a period of six years at the hospital of Saint-Germain-en-Laye. In 113 cases the operation was performed because of a definitely contracted pelvis, and in 47 of these there was another associated cause of dystocia. In this group of 113 cases there were 7 maternal deaths (6.19 per cent) and 5 fetal deaths (4.42 per cent). In the 45 other cases, there were various indications for the operation; there were 3 maternal and 3 fetal deaths, a mortality of 6.8 per cent. For the entire series of low cesarean sections, the maternal mortality was 6.32 per cent and the fetal mortality 5.06 per cent. The conditions which caused the highest maternal mortality were uteroplacental apoplexy and a fibroma complicating the pregnancy. The highest fetal mortality was associated with prolapse of the cord, frontal presentation, and central placenta previa at term.

A study of the maternal mortality in relation to the duration of labor shows that in 48 cases in which low cesarean section was done without any test of labor, there were 3 deaths, a mortality of 6.25 per cent; if 1 fatal case of uteroplacental apoplexy is excluded, the mortality was 4.25 per cent. In 68 cases in which low cesarean section was done in the early stage of labor, i.e., before the twentieth hour, there were 2 maternal deaths, a mortality of 2.94 per cent. When the operation was done between the twentieth and fortieth hours of labor, the maternal mortality was 10 per cent (2 deaths in 20 cases). In 3 cases in which operation was done after prolonged labor (over forty hours), there was one death (33.3 per cent). In 13 cases in which low cesarean section was done when the woman showed clinical symptoms of infection, the maternal mortality was 15.3 per cent (2 deaths in 13 cases). The fetal mortality also was lowest in the cases in which the low cesarean section was done after labor had begun but before the twentieth hour. The time of the rupture of the membranes also appeared to influence the maternal mortality. The lowest mortality was observed in those cases in which the section was done within twelve hours after rupture of the membranes.

These findings indicate that the most favorable time for the performance of low cesarean section is in the early stage of labor within a few hours after rupture of the membranes. In complicated cases (in which there is more than one cause for the dystocia) the fetus is less resistant than the mother; in such cases the operation should be done within ten hours after the beginning of labor, especially if the membranes have ruptured, in the interests of the child.

In this series of cases there were 63 in which the indication for low cesarean section was considered to be absolute: in 22 cases for contracted pelvis of a degree that rendered obstetrical delivery impossible, i.e., with a true conjugate of less than 8 cm.; in 7 cases for severe and dangerous failure of the uterine contractions; in 7 for threatening uterine rupture; in 10 for central placenta previa; in 8 for severe dystocia of the soft parts; and in 5 for general conditions rendering prolongation of labor dangerous.

In 83 cases the indications for low cesarean section were relative, but failure to operate would have involved sacrifice of the infant. In 16 cases, the danger of asphyxiation of the child was the chief indication; in 23 cases, faulty presentation or a large child; in 22 cases, contracted pelvis with a true conjugate of over 8 cm.; in 2 cases, recent prolapse of the cord; in 7 cases, failure of uterine contractions with less alarming symptoms than in the previous group; and in 6 cases, an elderly primipara who greatly desired a living child.

In 16 cases low cesarean section was done even though it involved a definite risk, but it appeared justifiable as giving the best chance for both mother and child. In 7 cases there was definite infection; in 1 case, that of a primipara of twenty-four years, there was uteroplacental apoplexy; and in 8 cases there were multiple fibromas or fibroma previa.

Aside from such complications, the maternal mortality in low cesarean section is about 3 per cent, whatever the indications for the operation. In determining whether or not a low cesarean section should be done when the indications are relative, the obstetrician must consider the age of the patient, her general condition, her own desire in the matter, and the possible effect on future pregnancies.

ALICE M. MEYERS.

MISCELLANEOUS

Garland, L. H.: The Shape of the Female Pelvis and Its Clinical Significance: Further Roentgen Studies. *Am. J. Roentgenol.*, 1938, 40: 359.

Female pelves may be classified into 4 main types: (1) the round or gynecoid, (2) the blunt heart-shaped or android, (3) the sagittal ellipsed or anthropoid, and (4) the transverse ellipsed or platypelloid. The obstetrical significance of these variations in shape is summarized by Caldwell and Morley as follows:

The gynecoid type of pelvis usually involves no special treatment during delivery except when found in the small, generally contracted form; in the android type forceps are often necessary, and if the condition is marked and diagnosed before the onset of labor, cesarean section can be advised; in the anthropoid form rotation of the head is often diffi-

cult; and in the platypelloid form the head must not be rotated into the narrowed anteroposterior diameter. Previous studies made by the author and his associates, to confirm or disprove these findings, led to the conclusion that the morphological classification was a clinically feasible one and that, in a significant number of cases, a difficult labor could be forecast in patients whose obstetrical measurements by ordinary methods appeared normal.

However, it was believed (a) that in the roentgen diagnosis of the different types of pelves, too much depended on subjective or personal opinions and too little on actual measurements; and (b) that a larger series of cases was desirable in order to confirm the validity of the conclusions drawn with regard to the prediction of dystocia. Accordingly, the study was continued and measurements were recorded of both the linear dimensions and the angles of the various architectural features relied upon in making a diagnosis. The present paper is a review of similar measurements taken in the last 150 cases, and a critique of the accuracy of the roentgen technique used in reproducing the structures under survey.

The architectural features on which this morphological classification is based are: (1) the pelvic outlet, (2) the subpubic arch, and (3) the greater sciatic notch and sacrum. The method used to obtain images of these structures, from which accurate deductions could be derived, is described in detail. The basis for roentgen interpretation is discussed, and diagrammatic illustrations of the differential features of the various types are included. The means used for obtaining measurements are given, and the findings are tabulated.

In this group of 150 unselected primigravidæ, 51 per cent were found to have gynecoid types of pelves, 21 per cent had android, 18 per cent had anthropoid, and 10 per cent had platypelloid types of pelves. Twenty-eight per cent had large inlets, 58 per cent had average size inlets, and only 14 per cent had small inlets. The clinical findings in this series of cases is to be published later. In the author's study of a previous group of 100 cases, the average duration of labor in the pure types was found to be as follows: patients with platypelloid types of pelves, thirteen hours; with gynecoid and anthropoid pelves, fifteen hours; and with android types of pelves, twenty hours. It was also observed that while only 13 per cent of the pure gynecoid types required instrumental interference for dystocia, 40 per cent of the pure android types, 28 per cent of the anthropoid, and 33 per cent of the platypelloid types required such interference.

A short discussion of the combination of pelvimetry with pelviography is appended. Objections to the methods of Caldwell and Morley with the "precision stereoscope" are given. In the author's experience, Johnson's application of the McKenzie-Davidson method has not been found practical. It is believed advisable that the pelvis be studied by each method separately if complete information is desired. Since the majority of female pelves are well within the normal limits in size, it will usually be of value to study them merely from the viewpoint of shape. However, in cases in which pelvimetry is indicated as well, the author believes that the method described by Johnson is simple and accurate.

ADOLPH HARTUNG, M.D.

URINARY LITHIASIS

Collective Review

C. C. HIGGINS, M.D., F.A.C.S., Cleveland, Ohio

IN recent years numerous clinical and experimental observations have been made in an attempt to ascertain the etiological factors associated with the formation of renal calculi. The high incidence of recurrence that has been reported following the surgical removal of a calculus stresses the necessity for carefully planned pre-operative and postoperative routines in all cases of urinary lithiasis. Certainly the operative procedure, *per se*, must be considered as only one phase in the treatment of patients with renal calculi.

ETIOLOGY

The relationship between the formation of urinary calculi and the absence of certain essentials in the diet has been noted by Fujimaki (30) in China, and by McCarrison (63) who have found that definite "stone areas" (regions where calculi are unusually frequent) exist in India where the people live on an improperly balanced diet. Joly (53) states that in England (Fig. 1) "stone areas" occur in Derbyshire and Westmoreland. Similar areas have been reported in China, Egypt, Palestine, the valley of the Volga in Russia, and in Dalmatia. According to Holmes and Coplan (44) calculi occur more frequently in southern California and southern Florida than in any other part of the United States.

From a study of the numerous stone areas that have been reported in different parts of the world, it is apparent that a definite deficiency in the diets of the inhabitants exists. This deficiency is not alone in Vitamin A but frequently in Vitamins B and D, or in some instances the diet is improperly balanced with regard to the acid-ash and alkaline-ash foods.

Guersel (34) studied calculous disease in Turkey and states that it has been proved that the geographic distribution of calculi corresponds to the areas where the inhabitants exist on poorly balanced and inadequate diets. He believes that poor nutrition and avitaminosis play an important part in the formation of stones. Vermooten (92) has found that the South African negro does not experience the formation of renal calculi as evidenced by an examination of the records of 1,091,000 negroes admitted to the Johannesburg General Hospital. At the same time, members of the white population in South Africa, as illustrated by the records of 126,000 admissions, have renal calculi in the ratio of 1:460 patients. He adds that the South African negro lives on a simple, stable diet which is rich in Vitamin A, has an acid-ash base, and is low in its content of calcium. Noble (67) in Siam found the largest number of stones among the poorer classes who lived in agricultural districts and the greatest incidence occurred in the first ten years of life. He states, "There is no doubt that the children who suffer from stone have a diet deficient in Vitamin A." Boshamer (6) reports that the various surgeons who operate in the central parts of southern China as well as Siam and Indo-China have been impressed by the frequency of calculous disease in the second, third, and fourth decades of life. Almost without exception, his patients who suffered with stones belonged to the poorest grade of society and he emphasized especially the frequency of vesical calculi in Kwangsi where he works. He believed that this was due to the fact that this is the poorest province in China, the diet of the inhabitants being comprised for the most part of boiled, polished rice. Milk, fruit, meat, and vegetables were only occasionally included and then in small amounts.

Joly (53) states, "I believe the hypothesis that stone is a deficiency disease is the most plausible and probable that has yet been advanced. It explains not only all the principle features of the condition today, but also changes in its incidence during past years. I believe that vitamin starvation acts primarily on the renal epithelium and through it on the colloid mechanism of the urine. Also that once this mechanism is deranged, stone formation must follow as a direct result of the laws of physical chemistry." Similarly, since the World War, there has been a definite increase in the incidence of calculous disease in certain parts of Europe. This has been explained by the fact that large numbers of people were required to partake of improperly balanced diets during the period of the war. Geza Illyes (49a) substantiates this by his statement that renal calculosis has increased enormously since the World

From the Cleveland Clinic.

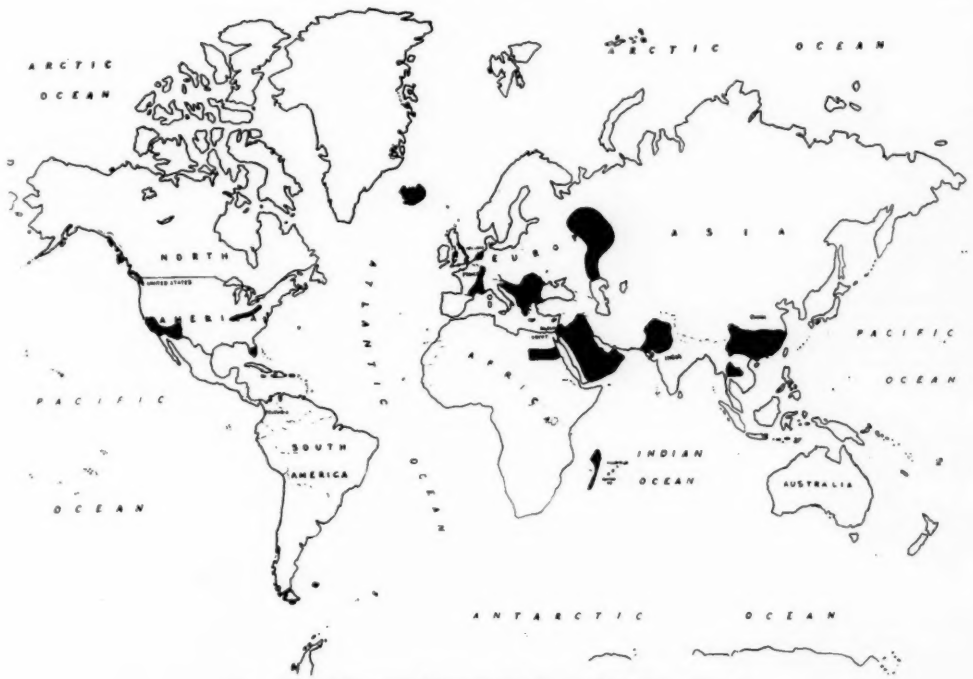

Fig. 1. Map of the world illustrating the so-called "stone areas."

War, especially in countries where living conditions have been poor. This again emphasizes the relationship between the formation of calculi and deficiencies in the diet.

It is likewise true that in certain countries a marked decrease in the incidence of calculous disease in children has occurred during the last century. Denos and Minet (23) and Civiale (17) stated that in the last century calculous disease was one of childhood, but according to Joly's findings in England and France it is now no longer a disease of childhood but rather one of adult life. This has been attributed to dietary and nutritional progress. In the valley of the Volga in Russia, however, calculi are still unusually frequent in children.

In addition to clinical observations, experimental data has shown the relationship between calculous disease and a poorly balanced diet. Calculi, both renal and vesical, have been produced in white rats which were maintained on diets deficient in Vitamin A. Osborne, Mendel, and Ferry (69), Grossman (33), and others have made such observations, and in 1933 I reported a series of experiments in which white rats were maintained on a diet deficient in Vitamin A for varying periods of time (39). At the end of two hundred days, post-mortem examination showed 88 per cent to have calculi of the bladder and at the end of two hundred and fifty days, renal calculi were present in 41 per cent.

Grossman (33), in a similar study, stated that microscopic particles of sand, which can be regarded as calculi, appear in the bladders of such experimental animals at the fifth week, but never in the kidney before the eightieth day. The majority of the calculi he found were composed of calcium phosphate.

Livermore, Bliss, and Prather (60) studied a group of 55 rats maintained on a diet devoid of Vitamins A and D. Calculi developed in 34 rats of this group while in 32 of 56 animals fed a diet devoid of Vitamin A, stones or sand developed. Van Leersum (91) and Perlmann and Weber (70) have substantiated these observations.

More recently, Hou (45) observed that by the addition of Vitamin D to the experimental diet which was deficient in Vitamin A, the incidence of the formation of calculi was increased, and the removal of Vitamin D from the same diet de-

creased the frequency of stone formation in albino rats.

Following the publication of our clinical and experimental work (39, 40), the objection was made that there was no indication that even mild degrees of Vitamin-A deficiency were present among any of the people of the United States. The criteria used by some authors and the basis of their impressions are gained only from the dietary history elicited from the patient. Such data are not sufficient to warrant the presumption that the patient is or is not receiving and utilizing adequate amounts of Vitamin A.

In addition, biophotometric studies now reveal that deficiency in Vitamin A occurs clinically much more frequently than has been presumed. Jeghers (52), in a study of a group of 162 students attending the Boston University School of Medicine, found that approximately 35 had photometric evidence of Vitamin-A deficiency and 12 showed clinical evidence. Youmans, in discussing Jeghers' paper, stated that he found subnormal dark adaptation in one-half of 50 clinic patients, the diets of many of whom were thought to be inadequate and in 11 of 54 supposedly normal subjects whose diets appeared to be well balanced. Jeans and Zentmire (51) in 1936 utilized the biophotometer test for detecting Vitamin-A deficiency in 100 children of middle and low economic levels in a rural community. They found that 26 per cent had a positive test for Vitamin-A deficiency and of 102 children of all economic levels in a village, 53 per cent presented similar findings. Of 70 children of middle economic level in the city, 63 per cent gave a positive test. In a study of 62 children of low economic level in a city, it was noted that a positive curve of Vitamin-A deficiency was observed in 79 per cent. Of 78 village and city children who had positive tests of Vitamin-A deficiency and to whom adequate amounts of Vitamin A were administered, all but 3 developed normal adaptation to darkness after a period of Vitamin-A therapy. Ezickson and Feldman (28) in 1937, by employing the dark adaptation or light sensitivity test, found that in 25 patients with urolithiasis 24 had pathological adaptation from a mild to severe degree.

In the cases of renal lithiasis studied at the Cleveland Clinic from 68 to 74 per cent gave photometric evidence of Vitamin-A deficiency (Fig. 2).

Clinical and experimental evidence, therefore, indicates that a relationship exists between the formation of calculi and the deficiency in Vitamin A and that biophotometric studies should be made in all cases of renal lithiasis.

HYPERPARATHYROIDISM

Barney and Mintz (4), Albright and Bloomberg (1), and others have stressed the relationship between hyperparathyroidism and renal lithiasis. In 1934 Barney and Mintz reported a series of 18 patients in whom a diagnosis of hyperparathyroidism had been made and verified by surgical intervention; in 11 (61.1 per cent) calculi were present in the urinary tract. Of the group of patients, 12 were females and 6 males. The youngest patient was thirteen years of age, the oldest sixty-two years, the average being forty-three years. Involvement of the bones to varying degrees was present in 12 cases, while in 6 cases urinary calculi and changes in the bones were found together. The calculi (renal) were bilateral in 4 (36 per cent) of the 11 cases. These observers concluded that hyperparathyroidism is responsible for from 4 to 5 per cent of the cases of renal lithiasis; in almost 70 per cent of cases of hyperparathyroidism, stones may be present; and in about 38 per cent of cases of hyperparathyroidism, the patients may have pathological changes in the bones and in the urinary tract. Barney and Mintz assert, and Albright and Bloomberg concur, that hyperparathyroidism is so frequently a cause of the formation of renal calculi that it must be determined whether or not it is present in every case. A careful study of the calcium and phosphorus content of the blood should be made in all patients with renal stones.

Griffin, Osterberg, and Braasch (32) in reviewing the cases of urinary lithiasis at the Mayo Clinic, state that hyperparathyroidism was found to be an etiological factor in less than 0.2 per cent of their cases. At the Cleveland Clinic, hyperparathyroidism has been associated with the production of renal calculi in 0.1 per cent of the cases (Fig. 3).

I believe, however, that it is important in all cases of renal lithiasis to determine the level of serum calcium and phosphorus in the blood, and likewise the phosphatase content of the blood. If there is an elevation of the serum calcium and a lowering of the serum phosphorus, further roentgen studies of the bones and an investigation of the calcium eliminated in the urine is advisable.

INFECTION

The relationship between infection and the formation of renal calculi has been discussed by several observers, including Braasch (8), Bugbee (11), Keyser (54), Rovsing (79), Quinby (75), and others. One of the most carefully and critically studied groups of patients are those reported by

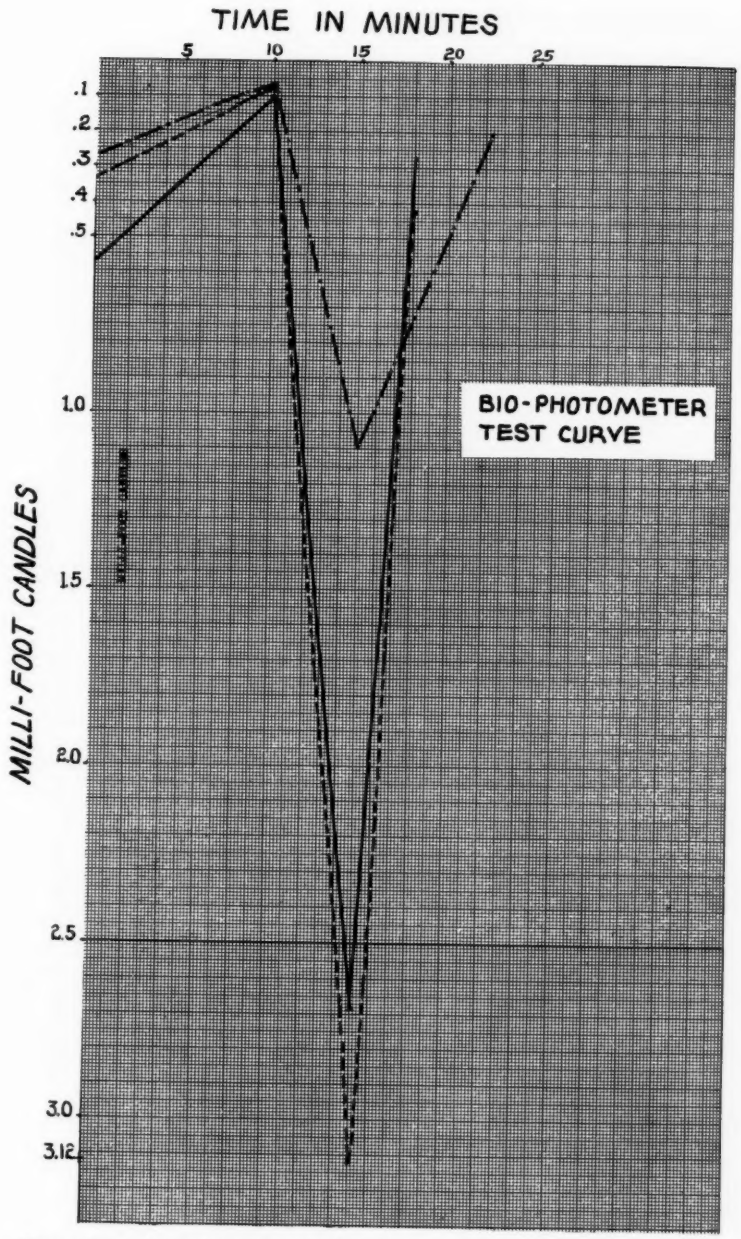

Fig. 2. Curve showing Vitamin-A deficiency in a patient with bilateral renal lithiasis and improvement following Vitamin-A therapy.

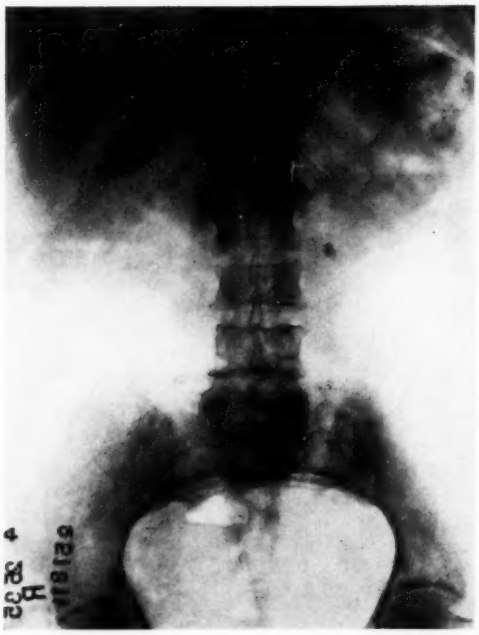

Fig. 3. Bilateral renal lithiasis associated with hyperparathyroidism. An adenoma of the parathyroid gland was removed.

Bugbee. His investigation was made to determine the presence or absence of pre-existing pyelonephritis as a possible factor in the formation of kidney stones. A definite history of pyelonephritis was elicited in 23 of 29 cases, and in 17 patients treatment had been administered during the initial attack. In the remaining 6 cases other physicians had treated the infection. Although roentgenograms did not demonstrate the presence of a calculus at the time the patient was first seen, stones subsequently developed in all these patients.

Ten examples of renal stones due to the staphylococcus were reported by Boshamer (6) in 1932. Formation of these calculi is probably due to the ability of certain members of this group to decompose the urine with the resultant formation of ammonia, a reaction favorable to the precipitation of calcium salts.

Lett (59) in reviewing the bacteriological studies in 638 cases of urinary lithiasis found 73 instances in which the urine was sterile, and in 3 additional cases the urine was found to be sterile at various examinations. Of 419 cases of renal calculi the urine was sterile in 49 instances. In the classification of the organisms, it was found that the staphylococcus albus was present in 318 cases, bacillus coli in 24.1 per cent, streptococcus in 13.8 per cent, and bacillus proteus in 12.2 per cent. Runeberg (80) in 1935 stressed the importance of anaerobic organisms in the genesis of calculi.

Stones may be produced in animals by infecting them with specific stone-forming bacteria isolated from the urinary tract of a patient with rapidly growing or recurrent calculi. Hryntschak (46) in 1935 injected cultures of the staphylococcus albus, bacillus coli, bacillus proteus, and bacillus lactis aerogenes intramuscularly one week after partial obstruction of the ureter was produced by a silk ligature. In 80 per cent of these animals, fine calcareous sand was found and, in a few, well defined calculi. These occurred, however, following the injection of the staphylococcus albus and not following injection of the other organisms. Hager and Magath (35) have produced calculi by use of the bacillus proteus and Keyser (55) with streptococci.

It is evident, therefore, that careful classification of the offending organism is important not only from the standpoint of the therapy to be instituted, but also from that of prognosis. In each case it should be determined whether the organism has the power of splitting urea with the resultant formation of ammonia and carbon dioxide. While reports in the literature indicate that the proteus group chiefly possesses this power, Brown and Earlam (10) have demonstrated that 18 per cent of the bacilli that infect the urinary tract have the property of splitting urea and 40 per cent of the strains of staphylococcus albus studied possessed similar properties. Therefore, in all cases, tests of urea-splitting properties should be determined (Figs. 4 and 5).

FOCAL INFECTION

Rosenow and Meisser (78) demonstrated the specificity of the streptococcus in the formation of urinary calculi. They inoculated the pulps of the teeth of 6 dogs with streptococci isolated from the urine of patients with urinary lithiasis. Following this, calculi developed in the dogs and streptococci were again isolated from the urine. In view of this work, foci of infection in the teeth, tonsils, prostate, cervix, and bowel should be eradicated.

STASIS

Urostasis in certain instances seems definitely to be associated with the formation of renal calculi and frequently is conducive to shifting of

Fig. 4. Staghorn calculus in the right kidney associated with a proteus infection.

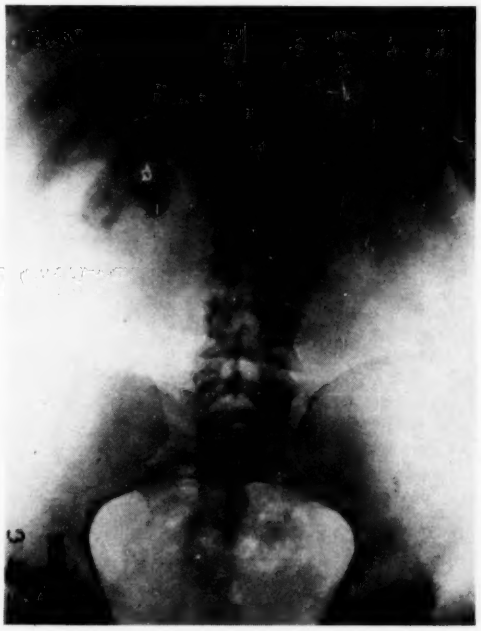

Fig. 5. Staghorn stone in the right kidney with coexisting infection due to the staphylococcus albus which split the urea.

the pH of the urine to the alkaline side. The observations of Hunner (48) emphasize the importance of ureteral stricture in the formation of stones in the kidney.

Bibus (5) states that mechanical factors are largely responsible for the formation of renal as well as vesical calculi. Disturbances of mobility and the presence of residual urine in the upper urinary tract are important factors. Bibus concluded that urinary infections also influence the formation of stones.

Stasis may be demonstrated by intravenous urographic studies which should be made prior to operation in order that the cause may be removed. They should be repeated again after operation before the patient is discharged from the hospital in order to ascertain that stasis has been eliminated. I believe this is an extremely important part of the routine in the decreasing of recurrences.

Snapper (84) believes that all factors which tend to stabilize labile colloids must help to prevent the formation of stones. The presence of salicylates, mandelates, hippurates, and other organic salts in the urine may, by increasing the stability of the urinary colloids, exercise a prophylactic influence against the formation of stones. He concludes: "Factors which may have a preventative or even a curative effect on the formation of renal calculi are:

"1. Administration of foods with an acid-ash which increases the acidity of the urine and the solubility of the calcium salts.

"2. Artificial acidosis by ingestion of ammonium chloride, ammonium nitrate, and other compounds.

"3. Large supply of vitamin A."

Residues of kidney stones and urinary gravel may be prevented by these measures. However, it is evident that the presence of hippurates, salicylates, mandelates, and other organic salts in the urine must also be of great importance for the prevention of renal stones.

Caulk (15) in 1913 described a papillary lesion of the kidney reported by Opie as follows, "Sections preserved in 40 per cent formalin and decalcified with 5 per cent nitric acid. The section of the papilla with the incrustation showed that the tip of the papilla was covered with homogeneous material which took a deep blue stain of decal-

cified material. The tissue of the papilla was dense and fibrous and contained very few cells. The tissue in immediate contact with the mass had undergone hyaline degeneration. In this hyaline area, as the calcified mass is approached, numerous minute calcified granules are seen. Deeper in the substance of the papilla, the tissue is loose in texture and contains numerous blood vessels. There are also collections of lymphoid cells." It was thought that this condition was due to a primary necrosis of the papilla with secondary depositions of calcium phosphate.

In 1937 Randall (76), following a series of investigative researches on renal calculi, presented two postulates:

1. A renal calculus in the absence of pelvic obstruction would have to have an initiating lesion in order to grow.

2. Such a lesion would have to occur on the renal papillæ.

In 1937 he (77) stated that calcium plaques in the renal papillæ were observed in 140 of 609 cases in which post-mortem studies were made. In this series of autopsies, 49 renal papillæ with stones adherent thereto were observed and, in practically every instance, the stone was growing from a deposit of calcium in the papillary wall. He states that the cause of this original observation awaits a thorough pathological study, but one thing seems definite from the material available in 1936: infection, *per se*, was not observed in any of the lesions studied at that time.

METABOLIC DISTURBANCES

Metabolic diseases, such as gout; permanent, non-infected phosphaturia; oxaluria (the latter stated by Neville (66) to be associated with Vitamin-B deficiency); or cystinuria, which is a disease of intermediate protein metabolism, may be associated with the formation of calculi. Seeger and Kearns (81) collected a series of 181 cases of cystinuria and found 124 instances of renal lithiasis. Since that time numerous authors have reported similar findings. Thus a complete metabolic study is required in this particular group of cases.

Siddal (83) states that most of the calculi seen in southern China are composed of uric acid, urates, and oxalates. In the rural districts where calculi are common, the source of the water supply is from wells and this well water is extremely hard, while in Canton where vesical calculi are not common the river water is the source of supply among the poorer classes.

From these clinical and experimental investigations, it is apparent, in view of our present knowledge, that many factors are associated with the formation of renal calculi. Therefore, a comprehensive pre-operative investigation is essential in all cases of renal lithiasis and the factors associated with the formation of the stone in the individual case must be eradicated in order to avoid a recurrence (Fig. 6).

RECURRENT RENAL LITHIASIS

Herbst (37) classifies recurrent calculi into two groups:

1. True recurrences or new formations of a calculus after complete removal of the original stone.

2. False recurrences or the persistence of stones or fragments of a calculus which were overlooked at the time of operation.

In 1915 Cabot and Crabtree (13), in reviewing the results secured in the treatment of renal stones at the Massachusetts General Hospital, stated, "Recurrence occurred in 56 per cent of patients treated by nephrotomy and 51 per cent of those treated by pyelotomy."

Brongersma (9) reported the incidence of recurrence to be about 16 per cent when slight or no infection was present in the kidney. When pronounced infection was present, recurrence occurred in about 50 per cent of the cases.

Barney (4), in 1922, reviewed a series of cases from the Massachusetts General Hospital and reported the incidence of recurrence to be 32 per cent following removal of a calculus from the kidney. In this group, a postoperative roentgenogram revealed that a stone was still present in the kidney in 9 of 20 cases, or 45 per cent.

Braasch and Foulds (8) in 1924 stated that calculi recurred in 10.79 per cent of the patients who were operated upon at the Mayo Clinic. Herbst (37) noted an incidence of recurrence of 15 per cent, while Hunner (49) in 1927 found that there was recurrence following 9.5 per cent of the operations for renal stones and 4.4 per cent for ureteral stones. Oppenheimer (68) published a paper in 1937 in which he cited the rates of true recurrence following pyelolithotomy, pyelonephrolithotomy, and nephrolithotomy as 14.9 per cent, 32.0 per cent, and 29.4 per cent, respectively. He stated that conservatism should still be the desideratum in the primary treatment of unilateral calculous disease.

Forty-nine recurrences in Geza Illyes' (49a) series were due to three factors:

1. Infection, the most important organism being the staphylococcus; the bacillus proteus and Friedlaender's organism were also found frequently.

2. Retention in the kidney, especially if cavities were present.

3. Diathesis which could be influenced by diet and modes of living.

According to Douillet (25) the average recurrence following surgical removal of renal calculi is 27 per cent more frequent when infection is present than when the urine is sterile, and it is also more common after nephrotomy than after pyelotomy.

Twinem (88), in 1937, reviewed the results of 314 operations for stone which had been performed at the New York Hospital. The percentage of recurrence following nephrotomy was 28 per cent and following pyelotomy 20.9 per cent. However, during the past one and one-half years, the recurrence was reduced to 5.36 per cent.

Keyser (56) reported 28 cases of recurrent calculi, of which 16 were personal cases. He was able to interrupt the cycle of recurrence by removal of the existing calculi, acidification of the urine, removal of local and focal infection, repeated cystoscopic lavage, and ureteral dilatations.

In the series of patients operated upon at the Cleveland Clinic, the incidence of recurrence from 1923 to 1932 was 16.4 per cent. Since that time, by use of the high Vitamin-A acid-ash or alkaline-ash diet which controls the pH of the urine, in addition to the other procedures employed in the past, the incidence of recurrence has been reduced to 4.9 per cent. A review of the last 100 cases of recurrent renal calculi that came to the Cleveland Clinic showed that the staphylococcus albus was the most frequently identified organism and then came the bacillus proteus. The recurrence developed most frequently during the first three years after operation in the group of unilateral cases, and during the first eight years in the bilateral cases. More striking was the observation that 223 operations were or had been performed on this group of cases of calculous disease, and that nephrectomy was or had been performed in 22 per cent.

Postoperative management, therefore, should consist of the elimination of stasis, eradication of local and focal infection, correction of deficiencies of Vitamins A and B if they be present, correction of metabolic errors, surgical treatment of hyperparathyroidism if it be present, and control of the pH of the urine from the kidney which harbored the calculus. The last is accomplished by dietary means, that is, the high Vitamin-A acid-ash or alkaline-ash diet, which depends on the chemical constituents of the calculus removed and the pH of the urine.

Fig. 6. Calculus in the right kidney and 2 stones in the bladder. Examination postoperatively showed them to be composed of cystine.

FORMATION OF RENAL CALCULI IN PATIENTS WITH FRACTURES OR PROLONGED INFECTION

Since 1855, following Virchow's work, reports in the literature have given ample evidence of the association of urinary calculi and diseases of bone.

In 1937, in a review of the literature, I (43) observed that in only a few cases had an examination of the calculus been made to determine its chemical constituents. However, the stones that had been analyzed were found to be composed chiefly of calcium phosphate; oxalates occurred in the calculi in a few instances.

The prevention of the formation of calculi in patients with orthopedic conditions consists primarily in the maintenance of the pH of the urine on the acid side. This can be accomplished by the use of the high Vitamin-A acid-ash diet which maintains the pH of the urine at from 5.2 to 5.4. Extreme care should be exercised to avoid infection of the urinary tract if catheterization is required. As it is desirable to maintain an acid reaction of the urine, medication with alkaline substances should be avoided. If the patient is recumbent, the position should be changed fre-

quently if at all possible. In fractures of the spine associated with the retention of urine, we believe that the use of Monroe's tidal drainage apparatus is preferable to overflow or frequent catheterization. If urinary infection is already present when the patient is first seen, frequent rechecks of the pH of the urine (cultures and smear of the sediment of the urine), and microscopic examination are essential. By such routine management the formation of calculi in this group of patients can be decreased.

Goldstein and Abeshouse (31), in 1935, reviewed the literature and added 14 additional cases. They mentioned the relationship between various chronic diseases of the bone and urinary lithiasis, placing emphasis on the proper dietary routine for patients with such conditions.

McCague (62), in discussing the clinical findings in 10 patients who were hospitalized because of trauma and in whom stones developed, stated that the average period in bed was five months, while the interval elapsing between the time of injury and the diagnosis of calculous disease was twenty months. In 4 patients the stones were bilateral, in 4 unilateral, and in 2 vesical calculi were noted. He stated that one of the most important factors in the prevention of this type of calculus was acidification of the urine and maintenance of its pH between 4.9 and 5.2.

Pyrah and Fowweather (74) in 1938 discussed the problem of urinary calculi in recumbent patients and presented 7 cases. In preventing such formation of renal stones they instituted active movement and massage of the limbs not actually splinted. In addition they forced fluids, turned the patient frequently if possible, used the acid-ash diet, administered Vitamin A, and controlled the bowel. They state, however, that the addition of the acid-ash diet is a rational means of increasing the rate of disappearance of the stones, and in their experience had proved extremely valuable.

BILATERAL RENAL CALCULI

Moerl (64) classifies bilateral renal calculi into three groups and states that they occurred in 13.9 per cent of his cases. When they are seen in cases of calculous anuria, he advises that the last organ involved is logically the better and should receive attention first. If there is a pyonephrosis and consequent destruction of the kidney, the opposite kidney should be operated upon first. If infection is present, however, the indications are more obscure and it is more difficult to reach a decision. Aseptic cases offer the best prognosis and it is better to treat the "good" kidney first.

Pugh (73) noted bilateral stones in 6 per cent of the children with renal lithiasis and in 12 per cent of the adults. He stresses that large bilateral calculi do not always require surgical intervention unless an emergency arises, such as blockage of the outflow of urine.

André (2), in discussing the management of bilateral renal calculi, stated that unless surgical intervention demands immediate attention, it is better to operate first upon the kidney with the least calculi which generally is the better.

Hryntschak (47) is of the opinion that bilateral renal calculi exert such a destructive action on the renal parenchyma that they should be removed surgically unless contraindications exist.

Twinem (89), in reviewing the cases of bilateral renal lithiasis from Lowsley's Clinic, is also of the opinion that, in general, the better kidney should be operated upon first in order that the patient have a better functioning kidney when the poorer one is operated upon. He stresses, however, that exceptions may arise, especially when the condition of one kidney demands immediate attention.

Winsbury-White (93) prefers to operate upon the better kidney first so that if, at the time the second one is operated upon, some factor requiring nephrectomy seems to be present, it may easily be decided whether it is wise to remove the kidney after the one on the opposite side has actually been handled. In certain advanced cases in which both kidneys are the seat of large masses of stones, he believes a permanent nephrostomy is indicated.

In a review of the cases of renal lithiasis seen at the Mayo Clinic, Priestley (72) found that 14.8 per cent of the patients had bilateral involvement. According to this writer, the treatment to be instituted depends upon the number of calculi present, their size, the extent of renal damage, and the age of the patient. Treatment may be conservative, or it may be necessary to institute radical operative procedures.

Stevens (85) states that conservative treatment may be advisable, or a surgical attack may be made primarily on one or both sides, the procedure depending upon the individual case. He believes that one should not be blindly guided by rules, but that the treatment instituted should depend upon a clear knowledge of the objectives sought (immediate and remote), of the means of attainment of these objectives, and the risks involved.

Tzschirntsch (90) believes that, if operation is advised, pyelotomy is the procedure of choice; then comes nephrostomy. He believes operation is advisable when it is impossible to leave the kidney intact, when danger to life can be averted

by operation, and when constant incapacitating pain is present.

Bibus (5) has said that the surgeon should choose for the operation neither the kidney which is in better condition nor that which is more diseased, on the basis of these facts alone. He is of the opinion that the kidney which endangers the life of the patient or which is itself in danger of destruction should be treated first.

From a review of the impressions of various authors, although various opinions are expressed, the consensus of opinion in general is that the better kidney should be operated upon first when surgical intervention is advisable. Obviously each patient must be individualized and treatment instituted which is warranted by a complete urological study in each case (Fig. 7).

Fig. 7. Bilateral renal lithiasis in which there was no associated renal infection.

URETERAL CALCULI

Crance (20) removed 72 of 77 ureteral calculi without operation. His technique is to retain catheters in place twenty-four, forty-eight, and seventy-two hours. As the catheters are about to be removed, one is plugged (if two are in the ureter); sterile water is then gently injected into one ureter until the patient feels discomfort in the side. The catheter is then slowly withdrawn while the syringe for injection is held in the other hand. Frequently the calculus was passed within twenty-four hours following this procedure.

Dourmashkin (26) states that a fairly large stone in the upper or middle part of the ureter should be removed by open operation following two or three unsuccessful attempts to move it past the obstruction, even in the absence of infection or apparent drainage through a groove. With a stone in the upper two-thirds of the ureter, when the obstruction has been passed, and with improved renal function and subsidence of the infection, longer waiting is advisable. The value of intravenous urography in this group of cases is stressed.

Foley (29) believes that manipulation and expectancy have been advocated too extensively and that the morbidity, mortality, and hardship to the patient have been underestimated. Aptly he states that such methods are truly conservative only when they best serve the patient's welfare.

Thompson (86) stresses that the transvesical removal of a ureteral stone is not an office procedure but should be restricted to hospitalized patients. At the Mayo Clinic they have used for years the method described by Bumpus (12), who advocates employing several ureteral catheters which, after passing the calculus, are twisted to enmesh it in the coils that are produced. Thompson states further that for the past few years he has utilized with satisfactory results the extractor described by Councill (18). The successful extraction depends upon the presence of sufficient room to allow free passage of the instrument and easy manipulation.

According to Moore (65), the larger the stone the less likely are manipulative efforts to succeed. A stone in the lower third of the ureter is more amenable to manipulation than one higher in the ureter. If the stone is lodged in the middle or upper third of the ureter and is not more than 1 cm. in diameter, one may wait until it comes down into the lower third of the pelvic portion before manipulation is undertaken. More important, if the calculus is more than 1 cm. in diameter and if it seems probable that more than three cystoscopic treatments or ureteral dilatations will be necessary before the stone is expelled, it is often less trying to the patient and possibly less hazardous to proceed immediately with extraperitoneal ureterolithotomy.

Emmett (27) classifies the manipulation of ureteral stones into two types:

1. The passive type, including the passage of ureteral catheters, dilatation of the ureter below

the stone with catheters or bulbs, or the injection of lubricants of various kinds into the ureter below the stone.

2. The active type, including the passage of instruments which grasp the stone, the passage of multiple catheters, or the use of various stone extractors.

Emmett believes that the passive type of manipulation is not difficult and seldom presents technical difficulties. It is also less effective unless the calculus is small and the patient is willing to endure several attacks of colic varying in intensity over varying periods of time until the stone is passed. The active type, however, is effective in a large percentage of cases if done skillfully and with great care. However, serious complications may result if careful technique and the utmost gentleness is not used.

Jarman and Scott (50) reported a series of 27 consecutive cases of calculi in the ureter, in 25 of which (92.5 per cent) the calculus was recovered after the passage of multiple catheters beyond the calculus followed by the injection of a 2 per cent solution of avertin. The solution is prepared by dissolving 1 gm. of avertin crystals in 50 c.cm. of warm sterile distilled water. In 13 cases (48.1 per cent) the stone was recovered as soon as the patient voided.

A review of the literature shows that the numerous methods of transvesical extraction of stones that have been recommended indicate the ineffectiveness of any one method. Extractors should never be forced into the ureter; gentleness of manipulation will prevent many complications. If, as Moore has stated, repeated manipulation which taxes the patient beyond endurance and may result in infection and chills and fever is necessary, surgical intervention should be instituted. Perhaps no pathological condition in the urinary tract tries the clinical judgment of the surgeon more than a stone impacted in the ureter.

SURGICAL PROCEDURES

From a review of the literature it is apparent that most writers advocate the employment of pelviolithotomy in uncomplicated cases of renal calculus when it is feasible. It is not, however, necessary in all cases to manhandle the kidney and deliver it well up into the incision. By careful dissection and adequate exposure, the kidney pelvis can be sufficiently exposed and the calculus removed, the kidney being allowed to remain in its normal position. After removal of the stone and in the absence of pronounced infection, the incision in the pelvis should be closed with ooo plain catgut, passed only through the outer coats of the pelvic wall.

When larger stones are present or a calculus occupies a position in a calyx with an associated stricture of the infundibulum, nephrolithotomy may be advisable. It should, however, be as conservative as possible, and it is preferable to pass a catheter into the pelvis and leave it there for irrigation and removal of clots which might be retained and act as nuclei for recurrent calculi.

Prather (71) has recommended a new approach for the removal of large calculi of the staghorn type. He advocates making a V-shaped incision on the posterior surface of the kidney, with the apex of the incision at the pelvis and the ends extending toward each pole and over the stone. With a small retractor lifting the flap of cortex, the stone may be visualized and removed without fragmentation. The nephrotomy incision is closed with oo chromic catgut, and a number 18 F Pezzer catheter is placed so that it emerges from the end of the incision at the lower pole. This is allowed to remain in place from fourteen to sixteen days. No secondary hemorrhages have occurred in Prather's cases. Occasionally technical difficulties may arise in the removal of a calculus from the kidney and require a nephropelviolithotomy, but in my hands it has seldom been necessary.

De Vincentiis (24) discusses the divergence of opinion as to the relative advantages of the electric cutting current and those of the scalpel. He made functional and histological studies on a series of 36 rabbits, employing a nephrotomy incision. After utilization of the cutting current, the concentration of the urea in the blood rose more than when the scalpel was used, and remained at a new level for approximately twelve days. In both types of incision there was increased elimination of urea in the urine. Nephrotomy with a scalpel was followed by death from hemorrhage in 3 rabbits on the second postoperative day. No deaths from postoperative hemorrhage occurred following nephrotomy when the cutting current was used. Microscopically, the zone of hemorrhage in the parenchyma with reference to extension did not seem to differ. More important, however, was the fact that in the tissue incised with the cutting current there was extensive necrosis of the parenchyma of the kidney, but in the tissue incised with the scalpel there was little necrosis and that was limited to the region of the incision. In tissue incised with the cutting current, this necrosis was more extensive and extended beyond the line of incision. After twenty-four days and still more com-

pletely after one month, the degenerative process and zones of necrosis had disappeared from the kidney incised with the scalpel, whereas in the instances in which the cutting current was used, degeneration and necrosis were still present, although to a less degree, throughout the entire period of observation, which was two months). De Vincentiis concluded that the kidney is extremely sensitive to the electric cutting current.

Counseller and Hoerner (19), in reviewing the results in cases in which nephrostomy was employed, stated that if the kidney is found to be rather extensively damaged and the seat of rather marked infection at the time of operation, it frequently is advisable to insert a nephrostomy tube, preferably through the lower calyx, to aid rehabilitation of the kidney. This permits not only excellent drainage but also direct lavage of the kidney as often as is desired. These writers report that gratifying results are frequently noted in restoration of function and eradication of infection following nephrostomy.

In a selected series of cases of renal lithiasis heminephrectomy may be a desirable procedure. The suitable cases are those with a calculus in a dilated, infected hydrocalyx at the upper or lower pole of the kidney containing a calculus. Even if the calculus is removed by a small localized nephrolithotomy, the infection may persist and eventually destroy the kidney. This is true especially when there is a coexisting stricture of the infundibulum.

In recent years, conservatism has become the byword in the treatment of renal calculi, especially since by a carefully planned postoperative routine recurrent calculi are steadily reduced.

In 1936 Shaw (82) reported on 4 cases in which vaginal ureterolithotomy was done and mentioned that, inasmuch as this procedure carries only a slight degree of shock, it may be performed on extremely ill patients. Higgins (41), in 1937, reported on 11 cases treated by vaginal ureterolithotomy and stated that this procedure offered a simple method for removal of a calculus impacted in the lower end of the ureter. In view of the absence of postoperative reactions, this technique may be employed in extremely ill patients in whom other surgical procedures would be attended by a high mortality. Furthermore the period of convalescence is shortened.

In 1932 Mann and Israel (61) cited 2 cases in which vaginal ureterolithotomy was performed. Hicks and Maris (38) also reported 2 cases, pointing out the possibility of the formation of fistulas. In a review of the cases reported in the literature, I have been unable to note the occurrence of this complication. With careful selection of patients, this is an invaluable surgical procedure, and patients critically ill, who I believe would have died from any other surgical procedure, have survived. No fistula occurred in any of our cases.

Thompson (87) in 1936 stated that during the past four years 161 patients with vesical calculi had been treated by conservative transurethral methods at the Mayo Clinic. In the past a considerable amount of hypertrophied prostatic tissue had always been deemed a contraindication to litholapaxy. Thompson believes, as a general rule, that it is best to crush the stone prior to prostatic resection, but if the lithotrite cannot be passed easily beyond the prostatic enlargement, it may be necessary to perform a transurethral resection of the prostate first. He reports cases in which he crushed and removed large calculi and performed a transurethral resection under the same anesthesia. This is undoubtedly the best procedure because, as a general rule, the vesical calculi can be crushed quite rapidly, and sufficient time is allowed for the prostatic resection. In general there seems to be a return to the more frequent use of the lithotrite in the removal of bladder stones. Again, however, it is not free from danger and complications, and individualization of the patient is essential. Hamer and Dykhuizen (36) believe from their observations of 22 cases that the treatment frequently depends upon co-existing conditions. The frequency with which hypertrophy of the prostate is present makes the treatment of this condition of primary importance. In their opinion, transurethral resection is also a satisfactory method of treatment for evacuation of a subcervical nest of small calculi.

Lazarus and Rosenthal (58) reported 15 cases of prostatic calculi, stating that the treatment depends upon the symptoms. If the patient was free from symptoms, diathermy and massage were recommended, suprapubic prostatectomy being recommended when an adenoma was associated with calculi. In 1934 Young (94) presented his findings in prostatic calculi. He believes the treatment varies with the individual case. If there are no symptoms, the prostatic secretion and urine are sterile, and sexual power is normal, operative treatment is not advised and frequently no local treatment is given. When pronounced symptoms are present, surgical removal is recommended. If possible in this group, perineal prostatolithotomy was recommended. The ideal operation according to Young is removal of the calculi without opening of the urinary tract.

Cahill (14), in discussing the problem of calculous anuria, the condition that accompanies the

suppression of urine caused by stones in the kidney or ureter, states that it occurs:

1. When 2 secreting kidneys both have ureters or pelves which are blocked simultaneously or one following the other.

2. When a solitary secreting kidney is blocked, the other having been destroyed by disease, previously removed, or imperfectly developed.

3. When both kidneys or a double kidney has a fused ureter blocked by a calculus.

4. When 1 of 2 kidneys which are apparently normal is blocked by a calculus, renorenal reflex stopping the secretion from the opposite kidney.

Cahill, in a comprehensive study of 22 cases, stated that cystoscopic examination in conjunction with retrograde pyelography was the most important diagnostic procedure. His first step in the treatment of calculous anuria was the relief of obstruction. The forcing of fluids subcutaneously or intravenously with a solution of dextrose of varying concentrations was of value in aiding the return of renal secretion. If secondary anemia was present in patients with infection, the renal output increased rapidly as the blood volume was restored to normal. In some cases, restoration of the renal secretion followed transfusion. In cases in which there was no coexisting infection, there was a rapid secretion of urine and elimination of the retained urea from the blood; when infection was present, secretion often did not start from twenty-four to forty-eight hours after nephrostomy. The relief of obstruction, forcing of fluids (dextrose) intravenously, and transfusions are therefore of prime importance in the treatment, other medication being administered as indicated by the blood-chemistry findings.

In 1937 (42) the present status of the dietary regimen in the management of urinary lithiasis was discussed by the author. A preliminary report of the results at that time showed the dietary regimen to be most applicable (1) in the prevention of recurrent renal lithiasis; (2) in the prevention of the formation of urinary calculi in patients with orthopedic conditions; and (3) in the prevention of the formation of calculi in patients who pass stones at frequent intervals but in whom a calculus is not demonstrable in the kidney.

Solution of a cystine calculus by strong alkalinization of the urine was described by Crowell (21), while Keyser (57) in 1933 reported partial solution of a carbonate stone. Pyrah and Fowweather (74) reported 2 cases of renal lithiasis in which the stones were dissolved; in 1 instance large bilateral renal calculi disappeared.

It has previously been stated that a calculus in the kidney should not be treated by dietary means if it is producing obstruction, thereby impairing renal function. Also, the diet should not be prescribed if a coexisting infection which cannot be eradicated is present, and it is obvious if the pH of the urine cannot be controlled no results can be anticipated. In spite of this, case reports have been presented in which a calculus in the kidney with a coexisting proteus infection has been treated by the acid-ash diet and acidifying agents. As the pH of the urine cannot be controlled by either, such treatment is contraindicated, as well as the use of ammonium chloride as discussed by Chute (16).

In a collected series of 32 cases, spontaneous solution occurred, but as only few cases meet the requisites stated when this treatment is advocated, usually only a case report is available.

Braasch (8) in 1938, in discussing blood calcium, phosphorus, and phosphate studies in urinary lithiasis, mentioned 2 cases in which 2 recently formed calculi were dissolved by acidifying drugs. Obviously again, indiscriminate use of the acid-ash or alkaline-ash diet in the medical treatment of renal lithiasis is to be avoided. In 2 instances, large renal calculi underwent fragmentation and decrease in size, but complete solution did not occur.

In patients with bilateral renal calculi, which frequently are associated with infection, the results have not been satisfactory. Therefore, treatment of the renal calculi by medical means is recommended in only a limited group.

CONCLUSIONS

1. From a review of the literature it is apparent that intensive pre-operative investigation to ascertain the etiological factors associated with the formation of the calculus is essential.

2. A diligent postoperative routine is required to prevent the formation of recurrent calculi.

3. Conservatism in surgical treatment is advisable.

4. The application of the high Vitamin-A acid-ash or alkaline-ash diet is of value in the prevention of recurrent calculi, in the prevention of the formation of calculi in patients with orthopedic conditions and in those who pass calculi at frequent intervals but in whom calculi are not present in the kidney.

5. The high Vitamin-A acid-ash or alkaline-ash diet is also of value in the solution of calculi in a selected group of patients.

6. Complete bacteriological study of the organisms present in many cases of lithiasis is essential in order that proper medication may be prescribed for eradication of the infection.

7. Close follow-up for three years, which is the maximum period of formation of recurrent calculus, is essential.

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GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Walters, W., and Kepler, E. J.: Surgical Lesions of the Adrenal Glands. *J. Am. M. Ass.*, 1938, 111: 1061.

Symptoms produced by a tumor of the adrenal cortex vary with the sex and age of the patient. These tumors occur most frequently in women, in whom they produce variable changes in secondary sex characters, such as cessation of menstruation, hypertrophy of the clitoris, atrophy of the breasts, excessive growth of hair on the face and body, and a florid complexion with acne and purplish striations of the skin. In girls, tumors of the adrenal cortex tend to produce precocious puberty, more masculine than feminine in type. These tumors seldom occur in males. They produce precocious puberty of the masculine type in boys, and feminism in adult males. Similar clinical pictures result from hyperplasia of the adrenal cortices, tumors of the gonads, or Cushing's disease. Routine laboratory studies have been of little aid in differential diagnosis, although a high content of estrogenic substance in the urine suggests adrenal cortical carcinoma, provided that pregnancy is excluded. Roentgenograms made after the injection of air into the perirenal fascial space aid in the localization of some adrenal tumors. In 40 cases of operation for adrenal cortical tumor, the mortality rate was approximately 50 per cent. Walters and Kepler attribute the absence of mortality in 7 consecutive cases in which operation was performed at the Mayo Clinic to improved methods in the treatment of postoperative acute adrenal insufficiency. These consist primarily in the administration of large quantities of sodium chloride and sodium citrate, the daily administration of cortical hormone, and the use of a diet that is low in potassium, throughout the postoperative period.

The most important adrenal medullary tumor is benign and produces attacks of paroxysmal hypertension. Operation was performed at the Mayo Clinic on 3 of 4 patients with this type of tumor, and the results were excellent.

In the authors' experience, the most accurate surgical approach to the adrenal glands has been through retroperitoneal and posterolumbar incisions.

Cirillo, N.: Some Cases of Closed Renal Tuberculosis (Sopra alcuni casi di tubercolosi chiusa del rene). *Prat. chir.*, 1938, 5: 79.

By the term "closed forms of renal tuberculosis," the author includes only those forms which are secondary to closure of the ureter, and are relatively rare when compared to the more common ulcerative and open forms. These closed forms present two main aspects, one a lumbar or abdominal tumor, and the other no tumor but atrophy of the organ; this difference in aspect depends upon whether the closure of the ureter occurs early, or slowly and relatively late.

Various classifications of the aspects assumed by closed renal tuberculosis have been proposed, the best being that given by Tarozzi. Practically all authors agree nowadays that renal tuberculosis is in the largest number of cases secondary to localization of the specific process elsewhere and is of hematogenous origin, but the debate on the manner of production of the morbid phenomenon is still going on. It is generally claimed that the most frequent primary localization is in the papillæ, and the observations of Tarozzi show that this site is the most favorable for the subsequent diffusion of the process and for its evolution toward the more common ulcerative form. According to many, miliary tuberculosis occurs generally at the beginning of all forms of chronic renal tuberculosis. Surgical statistics show that usually renal tuberculosis is unilateral.

Tarozzi's classification includes the various forms in which renal tuberculosis may be found: (1) miliary or acute hematogenous tuberculosis; (2) nodular or tuberous tuberculosis, or tuberculosis with intrarenal caseous foci; (3) ulcerative tuberculosis; and (4) the properly called closed tuberculosis, which is derived, on occlusion of the ureter, from ulcerative tuberculosis. Closed tuberculosis may be subdivided into (a) pure tuberculous hydronephrosis, which is very rare, (b) hydronephrosis with tuberculous or caseous pyelitis, which includes the improperly called tuberculous pyonephrosis, and (c) mastic kidney, representing the late aspect of the preceding form.

The author discusses 4 typical cases in which nephrectomy was performed. The changes found in the first case showed that the condition was an advanced hydronephrosis with tuberculous pyelitis, in which the closure of the ureter occurred at its junction with the renal pelvis. The histological findings aroused the suspicion that the tuberculous process was not spent. In the second case also, the hydronephrosis must have immediately followed the closure of the ureter before the ulcerative or caseous destruction of the renal tissue was far advanced. Roentgenography raised the question of the presence of a calculus, but pyelographic examination and meatoscopy, which revealed a typical specific perimeatal lesion, cleared up the diagnosis.

In the third case, the closure of the ureter had occurred later than that of the calyces, and the content of the upper half of the kidney consisted of caseous, milky-white material, while that of the lower half resembled the turbid albuminous liquid found in the first 2 cases. This patient had spontaneous and induced pain in the region of the kidney, and roentgenological examination revealed a difference in density between the upper and lower halves of the tumor.

The fourth case had all the characteristics of a typical mastic kidney and was considered the result

of a hydronephrotic condition with tuberculous pyelitis. The great decrease in the volume of the kidney was related to the lapse of time during which the renal process began and then evolved after closure of the ureter. The multiple small foci of calcification were due to a secondary precipitation of calcium in an alkaline medium. These findings and the presence of numerous zones of ossification in contact with the calcified zones showed that the process was spent and in a state of advanced sclerotization.

Although the possibility of spontaneous cure in these forms of renal tuberculosis cannot be disregarded theoretically, it must be considered as very exceptional in practice; therefore, nephrectomy is the only justifiable treatment.

RICHARD KEMEL, M.D.

Soloway, H. M.: Renal Tumors. A Review of 130 Cases. *J. Urol.*, 1938, 40: 477.

The author reports 130 cases of renal tumor, 90 of which were operative, and 40 were found at autopsy. He discusses the symptomatology and pathology of these growths in detail. From his analysis, he found that in 70 per cent of these cases the hypernephroma carcinoma was found. This tumor has a tendency to invade the renal vein and vena cava; because of its low progressive growth and its tendency toward hematogenous metastases it is frequently first diagnosed by the finding of metastases in the lungs and bones. It is therefore apparent that these tumors are discovered rather late, which accounts for the low percentage of good results. Soloway further advocates earlier complete urological studies to bring these growths to light prior to the formation of metastases, which were found in 93 per cent of the autopsies and in 15 per cent of the operative cases.

In these cases, nephro-ureterectomy and even sectioning of a portion of the bladder is justifiable. Although the author states that the actual benefit of x-ray and radium therapy in the treatment of these tumors is debatable, he nevertheless advocates their use. He emphasizes the need for a universal classification of neoplasms based on histological structure.

J. SYDNEY RITTER, M.D.

Howard, H. H., and Suby, H. I.: Perirenal Fibrosarcoma. *J. Urol.*, 1938, 40: 491.

True perirenal tumors may be one of two main types: (1) lipoblastomas, or (2) fibroblastomas, either benign or malignant. Tumors arising from the renal capsule are extremely rare, as are also the fibrosarcomas arising from the renal capsule, but the latter have been recognized and described for many years. These tumors may be very small, or they may become extremely large. This tendency to become very large seems to be one of their characteristic features. The abdominal mass may be the first sign noticed by the patient.

The case reported is that of a sixty-eight-year-old white man, whose chief complaint was weakness and loss of weight. For a year there was slight distress in the upper abdomen, and although the appetite was good, there was "not enough room" for a normal-sized meal. There was nocturia for several years, but no frequency, nor bloody or cloudy urine. Physical examination revealed a large firm irregular non-tender mass easily palpable in the left upper quadrant, which did not move with respiration. The non-protein nitrogen was 44, and the excretion of phthalein was 25 per cent in the first hour and 23 per cent in the second hour. A plain urogram showed a soft tissue mass in the left upper quadrant with some calcification in its upper border. The right pyelogram was normal, but the ureter was tortuous and slightly dilated. A left pyelogram showed multiple areas of calcification in the upper left quadrant with a large soft tissue mass in the kidney region. The pelvis and calyces were displaced upward and flattened, and the upper ureter was displaced to the midline. Intravenous indigo-carmine appeared in four minutes on both sides with equal concentration. At operation, the tumor was exposed extraperitoneally and a mass the size of a football was removed.

The gross specimen consisted of a large roughly ovoid mass, measuring 27 by 12 by 10 cm. and weighing 1,840 gm. The outer surface was slightly lobulated, yellowish, and smooth, and at the upper pole was covered with fat. Near the lower pole there was a soft, irregular hemorrhagic mass, softer than the rest of the mass, which was uniformly hard. The cut surface presented near the upper pole a kidney of normal size and appearance. This was unattached to the capsule, which was continuous with the mass. The mass extended for the most part below the kidney, and presented a hard, grayish-white surface with many white streaks and grayish-yellow irregular areas. The microscopic diagnosis was fibrosarcoma.

After three or four months, the patient again had pain and discomfort and a swelling in the upper left quadrant. Physical examination revealed a pallid definitely cachectic man, dry and uncomfortable. Palpation disclosed a large irregular mass filling the left upper quadrant, left flank, and extending medially to the umbilicus. The diagnosis was recurrent fibrosarcoma of the left flank. The urine contained a trace of albumin with some erythrocytes. There was a marked anemia and the non-protein nitrogen ranged between 30 and 46. The phthalein test showed an excretion of 25 per cent in two hours. High voltage x-ray therapy was started, but the patient's condition steadily became worse and he died.

At necropsy, a large irregular mass adherent to the parietal peritoneum was found filling the entire abdominal cavity except the right flank. The spleen was surrounded by tumor nodules attached to the main mass. The tumor was firmly adherent to the left leaf of the diaphragm and weighed 7,100 gm. The microscopic diagnosis was fibrosarcoma.

Sarcomas of the renal capsule present difficult diagnostic and therapeutic problems because they do not infiltrate and erode the renal pelvis and be-

cause their position is hidden. Hence the abdominal mass may be the first symptom. Gastro-intestinal disturbances (distress, food intolerance, and vomiting) may be a striking part of the picture. Pain may be a prominent feature, whereas toxic symptoms (fever, weakness, and weight loss) may be the first sign of disease. Urinalyses are usually negative. Pyelograms occasionally are negative, but usually show an obliterated renal shadow, a pressure defect of the renal pelvis, and, especially, rotation of the kidney. Several cases reported showed calcification in the tumor. At operation, the mass may or may not be encapsulated.

Recurrences after operation are the rule. Secondary operations are of no avail. It seems that immediate x-ray therapy should be instituted. The authors believe that a diagnosis should be made without exploratory operation. LOUIS NEUWELT, M.D.

BLADDER, URETHRA, AND PENIS

Gray, J.: An Investigation into the Condition of the Bladder Mucosa in Relation to Stone Formation. *Brit. J. Surg.*, 1938, 26: 259.

In China calculosis of the urinary tract most commonly involves the bladder. This may be explained at least partly by a lack of x-ray and other facilities for thorough investigation. The author draws attention to the similarity in the localization of the stone in experimentally produced calculosis in rats fed with diets deficient in Vitamin A. Most workers have found that with such diets stones tend to form earlier and more often in the bladder than in the kidneys. An attempt is made to correlate this observation with a histological investigation of the bladder mucosa in experimental animals and in patients with calculus.

The author has carried out such a histological examination on the epithelium of the urinary tract in rats on a Vitamin-A-deficiency diet and has found characteristic changes. In the early stage there is a marked hyperplasia, and often active mitosis in the cells of the deeper layers. Later the epithelium undergoes metaplasia of the squamous type, and in the last stages marked degrees of keratinization are present. The changes occur first in the bladder, especially at the base and around the internal meatus. The fundus may show slight changes or even no change at all when the involvement is marked at the vesical orifice. Changes also occur in the ureters and kidneys, but appear later, so that when the bladder is involved the renal pelves may still be normal. When the deficiency diet is carried on for a long period the changes are widespread through the urinary tract and so intense as to resemble carcinoma, but this condition could never be produced experimentally. This may be true because it is difficult to keep the animals alive long enough on such a severely restricted diet.

To answer the question of the possibility of a relationship between a Vitamin-A-deficiency diet and the condition of an individual, a study of the vesical mucosa obtained by biopsy during operation was made. Although, clinically, skin conditions due to Vitamin-A deficiency are frequently seen, patients on such diets seldom, if ever, have any evidence of urinary calculus. On the other hand, patients with urinary calculus, particularly children, more often than not have a remarkably clear skin with no hyperkeratosis, and it has not been possible in most cases to discover that their diet suggested a Vitamin-A deficiency. Of 11 cases studied, 7 showed obvious alteration of the mucosa of the squamous type and 4 showed keratinization. These changes are comparable to those found in experimental animals, but are never so intense. Both grossly and cystoscopically there was nothing pathological in the mucosa —certainly no leucoplakia or malacoplakia. Intravital staining procedures revealed no lesion cystoscopically. In a few cases of nephrectomy for stone the epithelium of the renal pelves showed no abnormality. With regard to the question of severe urinary infection as a causative factor, it may be said that the majority of the patients were infected, but a few had sterile urine, particularly children. Furthermore, in the experimentally produced condition, if the animals were kept in sterile cages, the urine did not become infected until quite late. The mucosal changes, and often the stones as well, were then already present. However, even in the experimental animals stones were sometimes found before the more extreme changes had occurred, and in the final stages stones were practically always present. It was found in practice that the addition of an excess of Vitamin D to the diet accelerated the formation of stones.

It seems reasonable to suppose that in the presence of such gross alteration in the integrity of the bladder epithelium the formation of a urinary calculus would be facilitated, particularly if the urine were already supersaturated with stone-forming substances.

LOUIS NEUWELT, M.D.

GENITAL ORGANS

Hamilton, T.: The Surgical Treatment of Prostatic Obstruction: A Nine-Year Review from the Newcastle Hospital. *Australian & New Zealand J. Surg.*, 1938, 8: 156.

The author reviews the results of 68 open surgical operations (14 suprapubic and 54 perineal) performed by a special organized group of general surgeons at the Newcastle Hospital over a nine-year period. With combined effort and favor of the perineal approach, the previous mortality of 27 per cent was reduced to 19 per cent. The average number of hospital days per patient was sixty-eight. Ten patients (14.7 per cent) had to be readmitted on account of recurrent obstruction, fistulas, and incontinence. Follow-up replies from 33 of 45 patients discharged from the hospital as clinically "cured" revealed the following: 14 (39 per cent) considered themselves entirely well; 4 (12 per cent) were well but had slight incontinence; 7 (18.6 per cent) were

in poor health and had unhealed sinuses and no bladder control; 8 were dead, 4 having died within a year. Six (16.6 per cent) of the 36 microscopic examinations of tissue removed showed carcinoma.

The author emphasized the need for improved postoperative care, closer supervision of and by the surgical and nursing staff, and more conservatism in the management of bad risks in public wards. Their statistics revealed an alarming morbidity and some unsatisfactory results. An important factor in reduction of the mortality rate at the Newcastle Hospital was the adoption of perineal prostatectomy when indicated. Hamilton stated that the challenge of an over-high mortality was still with us. It can and should be met. A lower mortality in public hospitals where a large percentage of the patients are bad risks seems possible only by the increased use of transurethral resection in the hands of a highly skilled surgeon. L. W. RIBA, M.D.

McDonald, S., Jr.: Observations on Chorio-Epithelioma Testis, with Record of a Case. *Am. J. Cancer*, 1938, 34: 1.

According to Ross, writing in 1932, some 131 cases of chorio-epithelioma testis had been published up to that time. In a survey of the literature since that date, McDonald encountered records of 11 additional cases. He gives brief abstracts of the following authors' cases: Storjohann (1932), Welchman (1933), Montpellier and Herlant (1933), Laetsch (1933), Videla and his associates (1935), Entwisle and Hepp (1935), 2 cases of Levi-Valensi *et al.* (1935), and 2 cases of Fortner and Owen (1935).

McDonald's case was that of a young man, aged twenty-four, with a swelling of the right testicle following an injury to this organ. He had noticed the enlargement two months before, and up to within two weeks of entering the hospital the enlargement had been painless. The growth had increased in size steadily. The right testicle was three times the normal size, and the growth was a hard, nodular, pear-shaped mass of uniform consistency. There was no enlargement of the regional lymph nodes. A diagnosis of teratoma was made, and the testis and cord up to the inguinal canal were removed. The pathological diagnosis was teratoma with epitheliomatous elements. The Aschheim-Zondek reaction was positive eleven days after orchidectomy. A quantitative Aschheim-Zondek test, made approximately six weeks later, showed 30,000 mouse units per liter. Approximately three months following the operation the patient began to show signs of metastases. He had considerable enlargement of the breasts, bilateral exophthalmos, wasting of the musculature of both lower limbs, and a small plum-colored, subcutaneous nodule on the tip of the right shoulder. The right kidney was palpable and enlarged. There was polyuria. X-ray examination showed widespread nodular metastatic deposits in both lungs. The patient died approximately three and a half months after the orchidectomy. The anatomical diagnosis following autopsy was generalized metastatic chorio-epithelioma testis. The breast tissue showed hyperplasia of the ducts and edema of the periductal connective tissue, attended by round-cell infiltration.

The author then reviews the literature on the histogenesis of this type of tumor. In the discussion regarding the histogenesis he says: "However, even without taking into consideration the evidence afforded by endocrine considerations, no convincing arguments against the morphological identity of chorionepithelioma testis with uterine chorionepithelioma have, in my opinion, been put forward. Such arguments are based mainly on cases similar to those described by Taylor (1910) and Ross (1932) wherein adenocarcinomatous elements have been present in either primary or secondary chorionepithelioma testis. As will be seen below, the existence of such cases is by no means inconsistent with the trophoblastic nature of these primary growths of the testis which are wholly or partially identical with the typical Marchand chorionepithelioma.

"On referring to the communications of Ross (1932) and Seror (1935), it would appear that those who uphold the teratomatous origin of chorionepithelioma testis fall into two distinct groups. One of these follows the opinion expressed by Marchand (1903), who considered that the ectoderm of a teratoma, no matter what view is taken of its origin, may possess the power to produce tissue similar to the ectoderm of a normal ovum, without necessarily involving the formation of true fetal membranes as postulated by Schlagenhaufer. On the other hand, it is held by some observers that the tumour arises as the result of some unknown stimulus applied to cells derived from the abnormal migration and arrest of *totipotent* blastomeres, which under the given stimulus may differentiate into ectodermal structures either as carcinoma or chorionepithelioma *or both*.

"In support of the theory of dislocated totipotent blastomeres a case reported by Ritchie (1903) may be cited. A cystic tumour of the anterior mediastinum in a man of twenty-four was found to consist of (*a*) a typical dermoid cyst and (*b*) chorionepithelioma developing in connection with a portion of the cyst wall. Furthermore, Hamdi (1934) has described what he considers to be typical chorionic epithelium in such widely differing sites as the wall of a subcutaneous dermoid cyst, the tunica albuginea testis, and a 'branchioma' originating in a thyroid rest.

"I would therefore suggest that if one assumes the origin of a testicular teratoma to be dependent on the presence of undifferentiated totipotent cells, the latter may form (1) an embryoma of 'adult' type characterised by the presence of rudimentary organs or (2) an undifferentiated tridermal embryoma in which attempts at organ formation are lacking. In either case, and particularly as regards the second, it seems reasonable to suppose that there are latent rests of the original totipotent cell from which may arise (*a*) adenocarcinoma, (*b*) large round-cell embryonal carcinoma (seminoma), and (*c*) chorionepithelioma or any combination of these. In theory the morphologic form which the tumour will assume de-

pends on the degree of differentiation of the stem cell to which the neoplastic stimulus is applied. Moreover, it is well recognized how the original teratomatous structure becomes masked by malignant proliferation and subsequent degenerative processes.

"In my opinion it must be clearly emphasized that a testicular 'tumour' should not be regarded as a true neoplasm until such time as unilateral malignant proliferation of one of its elements has declared itself, a phenomenon which is more likely to affect the tissues of an embryoma than those of a normal organ."

The author also discusses the endocrine considerations of this tumor, and he says there is strong *prima facie* evidence for the belief that the luteinizing gonadotropic hormone which occurs in the urine of pregnancy, retained placenta, uterine chorio-epithelioma, and chorio-epithelioma testis is in some way connected with the presence of chorionic tissue. The performance of quantitative tests for chorionic gonadotropic hormone would be valuable in the differential diagnosis of testicular new growths.

Gynecomastia should have little diagnostic significance as it appears in patients with testicular tumors which are not chorio-epitheliomatous. There should be a correlation of the amount of gonadotropic urinary hormone present and the histology of the growth, so that valuable information as to the nature and source of the gonadotropic hormone may be obtained. ALBERT MATHIEU, M.D.

Giuliano, A.: Carcinoma in Ectopic Testes (Cáncer en testículo ectópico). *Bol. y trab. Soc. de cirug. de Buenos Aires*, 1938, 22: 511.

Giuliano states that in 1919 Marotta published for the first time in South America the case of a seminoma which had developed in an ectopic testis. Since that time similar reports have been published in that country. From a statistical study, it appears clearly that carcinoma of ectopic testes is less frequently encountered in Latin-American countries than anywhere else, although the figures given are not entirely reliable.

The author observed the case of a thirty-three-year-old married man who at the age of eighteen had been operated upon for bilateral cryptorchidism. At the age of thirty this patient had suffered a severe injury of the left testis. When seen at the clinic he presented a bilateral cryptorchidism with the testes at the level of the external inguinal rings. For the past four months the left testicle had progressively enlarged in size and on examination the left inguinal region was found to be occupied by a tumor mass measuring 10 by 8 by 6 cm. The tumor was hard and fixed, and presented a smooth surface. A tentative diagnosis of carcinoma of the ectopic testicle was made.

Under spinal anesthesia the tumor mass was removed together with the regional lumbo-aortic lymph glands. Macroscopic examination of the specimen revealed the presence of a testicular tumor measuring about 9 by 7 cm. On sectioning, the surface appeared grayish-pink and of homogeneous structure. The normal structure of the testicle was completely obliterated and beyond recognition. The lumbo-aortic lymph glands were enlarged and markedly indurated. Microscopic examination confirmed the diagnosis of a seminoma of an ectopic testicle with metastases in the lumbo-aortic lymph glands.

Following the operation, deep radium therapy was instituted and the patient made an uneventful recovery.

According to the author, these tumors show a great tendency to form metastases not only involving the regional lymphatic chains but also extending into the supraclavicular, mediastinal, and pulmonary regions.

In these cases Giuliano advises simple castration followed by deep radium therapy, and he warns against radical interventions aiming at the removal of the deep intra-abdominal lymphatic chains. The dangers encountered in this connection include inadvertent injury to the inferior vena cava and the abdominal aorta. There is furthermore no special advantage in adopting radical procedures.

RICHARD E. SOMMA, M.D.

MISCELLANEOUS

Duff, J., and Williams, F. W.: Diabetes in Surgical Urology. *J. Urol.*, 1938, 40: 446.

As the result of a five-year study of diabetic surgical cases, the authors have concluded that the patient is a good surgical risk irrespective of the amount of sugar in the blood, provided he is not dehydrated, and that a minimum of sugar and no acetone are shown in the urine. The authors believe that dehydration and severe ketosis are the only contraindications to urgent surgery. The type of diabetes encountered in urological patients is usually mild, and in the event of death it should not be of diabetic origin.

A complete description of pre-operative and post-operative management of the surgical diabetic patient is given. There is also a résumé of a five-year compilation of data pertaining to patients whose cases were complicated by diabetes, some of whom were operated upon and others who were not operated upon. D. E. MURRAY, M.D.

FRACTURES OF THE NECK OF THE FEMUR

Five Year Collective Review

JAMES J. CALLAHAN, M.D., F.A.C.S., Chicago, Illinois

IN THE past five years there have been over 200 articles written on fractured neck of the femur. A review of this literature shows all the phases and intricacies of treatment, the mortality, and the end-results. There are three schools of thought, each favoring a different type of treatment. One is in favor of the plaster-of-Paris spica; another, in favor of closed internal fixation, and the last, in favor of open internal fixation.

PLASTER-OF-PARIS SPICA

The use of the plaster-of-Paris spica, the conservative method of treatment, was originally advocated by Whitman (66). In spite of active opposition, it has proved in some hands to be very efficient. This was demonstrated by Whitman in a report stating that in 441 cases of fracture of the neck of the femur in patients of various ages who were treated with the plaster spica, the mortality was less than 7 per cent and the union of the fractures varied from 53 to 90 per cent. Apfelbach and Aries (3), in using the walking plaster spica, report on 22 cases with no mortality and union in 77 per cent, with a hospitalization of only thirty days. Dickson (19) reports on 68 cases with a bony union in 70 per cent using the Whitman plaster spica. Cleveland and Bosworth (11) also have used the plaster-of-Paris spica cast and reported a union in 47.5 per cent of the patients surviving long enough to get a union. The immediate mortality in their series in which injury played an important part was approximately 14 per cent. They note a marked difference in the immediate mortality between ward and private patients. Of the ward patients 18 per cent died under treatment, while only 5.8 per cent of the private patients died. This difference in a large part is due to the nursing care, and stresses again the importance of constant care and observation required by patients enclosed in body casts. The author believes that the care of those imprisoned in plaster cannot be neglected if we hope to reduce the mortality with this conservative method. Kleinberg (34) reports 24 cases; 12 were true fractures of the neck of the femur and were treated with a body cast, which permitted the patient to be ambulatory. A solid bony union occurred in 22 of the 24 cases reported. Langan (36) reports the use of the Jones splint in the treatment of the neck of the femur and pelvis; he secured good functional results in the majority of his cases. Mills (45) passes a Kirschner wire transversely through the upper part of the condyles of the affected femur and attaches a horseshoe so as to stretch the wire forcefully. He then extends, internally rotates, and abducts the fractured member, and applies a Whitman plaster cast down to the knee, incorporating the horseshoe in the plaster. This procedure permits early flexion of the knee and eliminates stiffness.

From the statistical records available it appears that the age of the patient influences the percentage of bony unions. This has been emphasized by Henderson (27, 28, 29) of the Mayo Clinic, who estimates the prospect of repair at 90 per cent in patients under sixty years, and at 65 per cent in those beyond that age. Yet Stern (60) in a group of 17 patients over seventy years of age reports union in 78 per cent. Cotton (14, 15) has amplified the manipulative reduction and immobilization in plaster by artificial impaction, but with this form of treatment the percentage of unions, taking all ages into consideration, does not show a relation between the age of the patient and the percentage of bony union.

Additional evidence is added to the failure of the plaster-of-Paris-spica treatment by one of the exponents of the closed method; Leadbetter (37), reports a series of 81 cases. Fifty-nine of these were followed up accurately. The ages of the patients ranged from forty to ninety-two years. The period of observation was from one to nine years. All of the patients were treated by closed reduction and skin-coaptation plaster fixation. Good union resulted in 71.18 per cent; good function but no bony union in 6.79 per cent; failure in 13.57 per cent; and death in 8.46 per cent. Thus 22.03 per cent of the cases resulted in failure. Leadbetter, in a recent article, states "It is not by one stereotype form of treatment that the problem of the fractured hip will be solved. Both plaster fixation and internal fixation should be taught. Open reduction is not necessary but in the final analysis it cannot be denied *that internal fixation is more adequate than plaster* and that early

mobilization of the individual is most important in preventing chronic disability in the aged. Plaster fixation cannot be expected to yield good results consistently and logically in more than 65 to 75% of the cases."

CLOSED INTERNAL FIXATION

At the present the general trend seems to be toward internal fixation with the closed treatment. A special impetus has been given to this method by the advent of good, effective, lateral x-ray views of the hip joint. It is my opinion that this form of treatment, namely, internal fixation, would not be as popular as it is had lateral views of the neck of the femur been available in the plaster-spica cases (lateral views are now obtainable). The low percentage of unions was probably due to the failure of adequate reductions. Cotton (14, 15) believed that proper reduction or over-reduction, accurate approximation of the surfaces, followed by fixation with metal screws or pins to prevent rotation, with the least possible destruction of the bone of the neck, seem to have gained favor. For many years he had been an advocate of impaction and immobilization in plaster. Recently he stated "it is fair to say that blind nailing in one form or another has come to stay."

Internal Fixation with Screws: Brewster and Martin (6) report 53 cases treated by means of 2 screws, with union in 89.68 per cent and failure in 11.32 per cent. There was no immediate postoperative mortality attributed to the operative procedure. The screws used had a wide thread, rather than a machine thread, as it was believed that a better purchase on the spongy bone could be obtained. Goeckeler (24) reports the use of 2 screws for the reduction of the fracture by the Whitman-Leadbetter method. No final report is made. Lipmann (39) has developed a new device similar to a cork screw for securing and maintaining fractures of the femoral neck. Complete report as to the end-results is deferred until additional conclusive data have accumulated. However, thus far the device gives indication of fulfilling its purpose.

Internal Fixation with Wire: Gaenslen (22) reported 10 cases with encouraging results treated by means of a Kirschner wire in a subcutaneous spike fixation of the neck of the femur. Dyas and Aries (20) also used wires similar to Gaenslen. Telson and Ransohoff (61) report on 16 cases treated by axial fixation with steel wires in which there were 11 bony unions and 7 failures, either delayed union or death. Rowlette and others (52) in their cases of fractured neck of the femur were not satisfied with plaster-of-Paris spica nor traction, and being impressed by the reports of Knowles and Gaenslen because of the simplicity and cheapness of the subcutaneous pinning decided to adopt their methods. However, Knowles' method was modified to the extent that the stainless steel pins were threaded so that they could be screwed into the bone. End-results are reported in 29 cases: 6 patients died; 7 had non-union; and 13 had a good firm bony union. In 3 the end-results were not determined. Therefore, 45 per cent of the first 29 cases have had what appears to be a firm bony union.

Internal Fixation with Wires, Flanges, Pins, and Nails: Great credit should be given to Smith-Petersen as he has revived the use of metal in the neck of the femur, and it is my opinion that the present trend of internal fixation is a direct result of his efforts.

Many surgeons realized the possibilities of the use of the Kirschner wire for maintaining accurate reduction after manipulation, but were afraid that the wires either were not strong enough or would migrate into the pelvis, and therefore they were in search of a more adequate form of fixation. Accordingly they adopted the use of the Smith-Petersen nail modified by Johannson (31, 32), whose procedure is as follows: The Kirschner wire is drilled into position after reduction of the fragments and the Smith-Petersen nail is threaded over this wire and driven in through the trochanter, neck, and into the head of the femur, the fragments being thus secured in anatomical position and impacted, or better, approximated in accurate position. Johannson reports 125 personal cases with bone healing in 100. Burman (7) has adopted the Johannson method and reports good results. Ferciot (21), in using the Kirschner wire and the Smith-Petersen nail, believes that this procedure causes very little shock to the patient and can be carried out under local anesthesia, also, that it reduces hospitalization, and permits early mobilization, and that union occurs in from 75 to 90 per cent of the cases so treated. Bailey (4) reports a method for the accurate introduction of the Smith-Petersen nail over a Kirschner wire based on two anatomical facts: (1) the anterior surface of the neck of the femur is a comparatively flat plane extending on to the anterior surface of the shaft immediately below the greater trochanter; (2) a line through the center of the neck passes ½ in. behind this plane and emerges from the outer surface of the femur ½ in. below the lower border of the greater trochanter under cover of the origin of the vastus externus muscle. With the use of an introducer, the Kirschner

wire is driven in and the Smith-Petersen nail is guided over the wire and impacted into the neck. The wire is then withdrawn. Cases treated by this method have been satisfactory.

Grondahl (25) of Bergen, Norway, reports that after using Kirschner wires similar to those used by Dyas and Aries, he has entirely discontinued their use and has found the Smith-Petersen nails with the technique of Johannson far superior. This is also concurred in by Gilson and his associates (23). Luck (40) reports using a special device for obtaining the proper position of the Kirschner wire and modified Smith-Petersen nails. He reports good results. Cox (16) reports 18 cases satisfactorily treated with the Smith-Petersen nail with a hole in it. The youngest patient was fifty and the oldest eighty-four years.

Believing the Kirschner wire too small and flexible, and realizing the danger of its bending and curling on itself within the head, Campbell (9) used a larger wire with the modified Smith-Petersen nail. He reports the use of this method in 35 patients, 6 of whom died before end-results could be determined; none of these deaths was immediately postoperative. All of the patients under observation had an osseous union and, what is more, 17 of them have practically normal function in the hip and knee joints. It is Campbell's opinion that the presence of metal delays union, but the fixation attained apparently overcomes this objection and greatly enhances the normally delayed physiological process. Jackson (30) of Madison, Wisconsin, informed me that he is using a large pin guided by a protractor accompanied by the Smith-Petersen nail and is producing satisfactory results. Carrell (10) reports a simple method for the introduction of the Smith-Petersen nail with the use of a drill; however, he claims no originality for this method as it is similar to that of Wescott and others. The insertion of the drill determines the size of the Smith-Petersen nail, which is then threaded over the drill and driven in. Additional drill holes are made around the nail for circulatory channels. Following this procedure plaster leg supports are applied to both legs from the calves to and including the feet; cross bars maintain abduction. These splints are allowed to remain on four weeks. A brace is then worn for six months. The nail is later removed. No results are given. Carrell believes good function indicates a comfortable, easy gait; very little, if any, limp; 90 degrees or more of flexion; and fair abduction and rotation. Encouraged by the use of various forms of fixation Moore (46, 47, 48) devised the use of 3 nails. These nails are threaded and fitted with nuts at the distal third. They are inserted by the closed method. Following this a piece of orthodontic stainless steel is wrapped from one pin to another and securely laces them together. The pins have been inserted with their points converging from an equilateral triangular base. This small wire positively prevents any or all of the pins from working out backward. The nuts prevent the pins from going forward and the nuts cannot work loose because of the wire wrapped behind them. In a recent article Moore reports on 24 cases, 1 with non-union and bony union in 96 per cent. This method has been adopted by Conwell and Sherrill (13), who report on 21 cases; the oldest patient was eighty-five and the youngest twenty-eight years. No deaths occurred and the average period of hospitalization was ten days. In this series there were 2 cases of non-union. It is the opinion of these authors that both of the patients in these cases commenced weight-bearing too early. However, in 1 case, there was a possibility that an interposition of the soft structures between the fragments was present. Conwell and Sherrill state further that no form of internal fixation should be considered a panacean treatment. Caldwell (8), realizing the advantages of Moore's method of treatment, employed this method in 44 cases, 29 of which were fractures of the neck. Twelve of the patients have died, but only 1 of the deaths was caused by infection. There was no attempt made to select the cases and many of them were obviously unsuitable for a spica or any form of traction because of feeble circulation, obesity, or incontinence. Caldwell believes that these fractures can be pinned and the period of survival is much more comfortable for the reason that the patients can be shifted in bed without the discomfort and agony which usually follows in those cases in which no fixation has been applied. A conclusion has not been offered by Caldwell; however, it is his opinion that by a judicious selection of the cases the mortality should be reduced and good end-results secured. Wescott (63, 64) employs the closed reduction as follows: the fracture is reduced and stereoscopic roentgenograms are taken; an incision from 2½ to 3 in. in length is made below the greater trochanter; and a small hole is bored into the bone with an osteotome to receive the blades of the nail. The length of the nail and the degree of angulation of the neck with the shaft are determined from the roentgenogram; then a bone protractor is set at a like angle and clamped. The nail is then driven in. This operation produces a minimum amount of shock, allows immediate active use of the joint, and prevents the usual complications expected from a prolonged period of

fixation and recumbency. Wescott reports on 33 cases. There were 3 cases of non-union following the operation, 2 of them due to lack of co-operation. Three deaths occurred, but it is Wescott's belief that they could not directly nor indirectly be attributed to the operation. A complete list of the end-results is not published.

Thornton (62) of Atlanta, Georgia, reported at the Congress of the American College of Surgeons in October, 1937, that he used the Smith-Petersen nail immediately after the fractures occurred, and secured excellent results. Bozsan (5) of New York suggests drilling of the greater trochanter, and of the neck and head of the femur ten days after the fracture followed by immobilization in a Whitman plaster cast, and reports excellent results. Anderson's (2) new method, which as yet has not been published, was demonstrated at the American College of Surgeons Meeting in Chicago, 1937. He advocates the use of the pin in the condyles of the affected femur instead of in the tibia. He believes firmer fixation and immobilization can be obtained by this method. Plummer (51) states that he is not satisfied with wires as they are inadequate mechanically and are dangerously prone to wander into the pelvis. He also used Moore pins, but they failed to satisfy completely the mechanical requirements, and at the present time he has been receiving excellent results from the Smith-Petersen nail. He reports 37 cases with 9 deaths. O'Meara (49) reports on his use of the Smith-Petersen nail with the closed method in 14 cases, the average age of the patients being sixty-eight years. He had 1 failure. White (65) has devised an instrument facilitating the use of the flanged nail in the treatment of fractures of the hip. The nail is very similar to the Smith-Petersen. The advantage is that a combined impactor and extractor may be screwed into the distal end of the nail.

Smith-Petersen (58), who is responsible for the present impetus of internal fixation in the neck of the femur, has now forsaken his first love and been converted to the closed reduction. Smith-Petersen states, "Five years have elapsed since the first report on internal fixation of fractures of the neck of the femur by means of the flanged nail was published. The principle of the nail has been widely accepted, not so the open reduction. In view of the good results reported from the use of the closed reduction, followed by nailing through a small incision, we have come to the conclusion that the open reduction is unnecessary in fresh fractures; in old ununited fractures open reduction is indicated and good results are obtained in selected cases."

OPEN INTERNAL FIXATION

Having covered the opinions of various men advocating conservatism and using the plaster-of-Paris spica and who prefer the closed reduction with internal fixation, we now come to the opinions of those who prefer the open reduction.

Harris (26) of Toronto, Ontario, reports on 50 cases treated by the open method with the Smith-Petersen nail. Firm bony union resulted in 72 per cent; imperfect union in 4 per cent; and failure and death in 24 per cent. Jones (33) of Liverpool, England, reports using the Smith-Petersen method from 1930 to 1933. He had a total of 59 cases. The average age of his patients was fifty-seven years. Twenty-nine or 49 per cent of his patients were operated upon. Failure occurred in 4 and 2 patients died. Bony union occurred in 23 or 79 per cent. Jones also used a lateral approach with exposure of the fracture, which was followed by nailing. Forty-one patients were treated in this manner; their average age was sixty years. Thirty-five or 85 per cent were operated upon with 1 failure from sepsis. Two died. Bony union occurred in 29 or 91 per cent. Albee (1) also used the open operation, employing an autogenous bone graft peg of a large size, which in his opinion furnishes immobilization and active osteogenetic bone cells to the fractured junction.

McMurray (43) of Liverpool, England, advocates the use of the oblique osteotomy in fresh cases, having been encouraged by its use in old cases. He reports on 4 cases of transcervical fracture treated by this method, and anticipates good results. His choice of this method is based on the following facts given by him: "Drawbacks of the Whitman and Smith-Petersen Methods: The advantages of these two methods are evident. By their use the end-results of treatment of this type of fracture have been greatly improved; but neither method is without risk, and their true value can only be appreciated by realizing their disadvantages, which in Whitman's method are: (1) the frequency with which non-union follows on even the most careful treatment; (2) the risks to these elderly patients which follow on prolonged fixation in the very uncomfortable position of abduction and hyperextension; (3) the rigidity of the joints which is caused by the fixation and twisting of the limb over a long period. The disadvantages of the insertion of a metal pin are: (1) the risks of failure to insert the pin in the ideal position, and the very definite risk of non-union; (2) the occurrence of fragmentation in the head of the femur following an apparently successful operation; (3) the very definite risk of infection in the hands of non-experts in the method."

It is Magnuson's (42) opinion that if there is considerable obliquity of the fracture line, visual reduction is preferable with fixation applied while the fracture is in view. The line and plane of the fracture and the amount of displacement immediately after the injury are factors to be considered in the prognosis and the treatment. Magnuson reports good results following the use of his modified Brackett operation in fresh cases. Cubbins, Callahan, and Scuderi (17) have developed a new incision for the exposure of the neck of the femur and employ the Scuderi-Callahan 2-flange nail and director. The stimulus for this work was the poor results obtained by the closed method. It is our opinion that interposition of soft tissue, failure of accurate reduction and approximation, and lack of firm immobilization were the pitfalls of the closed method. We have operated on 105 cases with firm bony union in 90 per cent and 1 death. In an article Dickson (19) states that he has used the Smith-Petersen nail in 9 cases and secured a bony union in 7 or 77 per cent. Death occurred in 2 or 22 per cent. He emphasizes the difference between open and closed fixation by revealing that the abduction method produced a bony union in from 53.8 to 70 per cent of the cases and a mortality of from 13 to 25 per cent, while the end-results of the open reduction varied from Albee's union in 97.4 per cent to Smith-Petersen's union in 83.8 per cent, with a mortality of 10 per cent. These figures would indicate that the open method gives decidedly better results and a lower mortality. Cubbins, Callahan, and Scuderi's results confirm Dickson's conclusions.

Non-union of old fractures.

Albee's (1) observation of 412 non-unions over a period of twenty-five years has shown that there was almost a complete absence of blood supply to the capital fragment in these cases, and it is his opinion that the blood vessels are either torn at the original injury or occluded later. With Wolcott's permission, Albee states, "that anatomically there are meager or no blood-vessels in the ligamentum teres in 15% of cases, and inasmuch as his findings in non-unions showed no blood-supply from this source in close to 100%, it is apparent that the trauma resulted in its destruction in the remaining 85%." However Kruecher and Chandler's (35) opinion differs regarding the blood supply in the ligamentum teres. It is based on a study of the ligaments removed from 60 adult cadavers, the average age of the patients being forty-eight years at the time of death. Histological preparations were made near the junction of the ligament with the femoral head. These authors stated that *all ligaments* contained vessels, but there was considerable variation in the number of vessels found. Simpson and Henderson (57) reported a new method with a lagscrew fixation in ununited fractures of the neck of the femur. This method was developed because in some instances the metal flange nail became loose. Three cases were reported with good results.

Henderson (27, 28, 29) also reports that of 632 patients who came to the Mayo Clinic because of fractures of the hip there were 410 with old ununited fractures. The latter were dismissed without treatment because fibrous union was giving sufficient support, or because senility, cardiovascular disease, nephritis, diabetes, or other conditions rendered surgical intervention too hazardous. In 222 cases of either fresh or old fractures of the neck of the femur treatment was advised. Of these 97 were ununited fractures of the neck of the femur. Of this group 59 were operated upon and an autogenous bone graft was inserted. Henderson prefers the Kirschner wire as a guide for its insertion. Bony union was reported in 70 per cent of these cases. A beef-bone peg or screw was used in 10 cases and successful results obtained in about 50 per cent. Whitman reconstruction was resorted to in 23 cases and was the operation of choice for skeletal support. The Brackett operation was used in 5 cases and the results were so satisfactory that it is Henderson's opinion that it should be employed more often.

Colonna (12) reports 15 cases of old ununited fractures of the neck of the femur treated with his own method of reconstruction; very briefly the essential features are:

1. Sectioning close to their insertions all of the muscles attached to the region of the greater trochanter, preserving a thin layer of fibro-muscular tissue over the upper end of the bone.
2. The removal of the loose head.
3. The placing of the upper extremity of the femur deeply and firmly within the acetabulum and transplanting of the gluteus medius and the gluteus minimus group of muscles downward on the shaft of the femur as far as they will reach, securely fastening them to the underlying bone.

Thirteen of these patients are still living, and with the exception of 1 in whom operation was a failure and 1 who died, all present excellent hips. Macey (41) concurs with Colonna in his reconstruction operation.

As a substitute for the more extensive surgical procedures the Schanz osteotomy (53, 54, 55) is becoming popular, the mechanics of which are as follows: "Through the angulation of the neck, the fracture site is placed below the head and the body weight no longer pushes the head downward

Author	Type of treatment	No. of cases	Mortality	End-results
	PLASTER-OF-PARIS SPICA			
Whitman	Casts	441	7%	53–96% bony union
Apfelbach and Aries	Walking cast	22		77% bony union
Dickson	Casts	68		70% bony union
Cleveland and Bosworth	Casts		14%	
Kleinberg	Ambulatory casts	24		91% bony union
Langan	Jones splint			Good
Mills	Kirschner wire in condyle—cast			
Stern	Casts	17		79% bony union
Cotton	Casts			Good
Leadbetter	Casts	81	8.46%	71.18% bony union
	CLOSED INTERNAL FIXATION			
Brewster and Martin	2 screws	53		89.68% bony union
Goeckeler	2 screws			
Lipmann	Cork screw			
Gaenslen	Wires	10		Encouraging
Dyas and Aries	Wires			Good
Telson and Ransohoff	Wires	16		7 failures
Rowlette, and Others	Wires	29	6 deaths	45% bony union
Johannson	Wire and Smith-Petersen nail	125	12 deaths	100 bony union
Burman	Wire and Smith-Petersen nail			Good
Ferciot	Wire and Smith-Petersen nail			75–90% bony union
Bailey	Wire and Smith-Petersen nail			Satisfactory
Grondahl	Wire and Smith-Petersen nail			Satisfactory
Gilson	Wire and Smith-Petersen nail			Satisfactory
Luck	Wire and Smith-Petersen nail			Good
Cox	Wire and Smith-Petersen nail	18		Satisfactory
Campbell	Wire and Smith-Petersen nail	35	6 deaths	29 good unions
Jackson	Pin and Smith-Petersen nail			Satisfactory
Carrell	Drill and Smith-Petersen nail			
Moore	3 nails	24		96% bony union
Conwell and Sherrill	3 nails	21		19 good
Caldwell	3 nails	44	12 deaths	
Wescott	Smith-Petersen	33	3 deaths	
Thornton	Smith-Petersen nail			Excellent
Bozsan	Drilling and casts			Excellent
Anderson	Pin in condyle of femur			
Plummer	Wires and Smith-Petersen nail	37	9 deaths	
O'Meara	Smith-Petersen	14		1 failure
Smith-Petersen	Smith-Petersen nail			Good

Author	Type of treatment	No. of cases	Mortality	End-results
	OPEN INTERNAL FIXATION			
Harris	Smith-Petersen nail	50	24%—death & failure	72% bony union
Jones	Smith-Petersen method	59	2 deaths	79% bony union; 4 failures
Jones	Watson-Jones method	41	2 deaths	91% bony union; 1 failure
Albee	Autogenous bone peg			Good
McMurray	Oblique osteotomy (fresh cases)	4		Expect good results
Magnuson	Brackett (fresh cases)			Good
Cubbins, Callahan, and Scuderi	Scuderi-Callahan flange	105	1 death	90% bony union
Dickson	Smith-Petersen	9	22%	77% bony union
	NON-UNIONS OR OLD FRACTURES			
Simpson and Henderson	Lagscrew	3		Good
Henderson	Fibula and Kirschner wire	50		70% bony union
Henderson	Beef-bone peg or screw	10		50% bony union
Henderson	Whitman reconstruction	23		Good
Henderson	Brackett	5		Very satisfactory
Colonna	Colonna reconstruction	15	1 death	13 good; 1 failure
Macey	Colonna reconstruction			Satisfactory
Schumm	Schanz osteotomy	13		Satisfactory
McMurray	Lorenz bifurcation	27		Very satisfactory

past the fracture surface but directly against it. This provides more favorable weight bearing relations and may even lead to late bony union." Schumm (56) reports 13 cases of non-union of the neck of the femur in which the Schanz osteotomy was performed with a minimum amount of shock and satisfactory results. McMurray (43) of Liverpool, England, stated in 1936 that he preferred the Lorenz bifurcation in ununited fractures of the femur and reported 27 cases resulting in very satisfactory end-results. In a subsequent report in 1938 he gives a detailed account of the treatment of fractured neck of the femur by oblique osteotomy, which he believes is very efficient in the treatment in fresh cases or cases of non-union.

The two methods that are used to obtain bony union in ununited fractures of the femur are: (1) bone grafting, with autogenous and heterogeneous grafts which are fastened with pins, screws, and flanges; and (2) reconstruction (Whitman, Colonna, Brackett, Lorenz bifurcation, and Schanz osteotomy). Regardless of how well many of the above operations are performed we are reminded by Henderson that, "Even if the mechanical requirements of reduction and fixation are fully complied with there is still a nigger in the wood pile, that is, the blood supply of the head of the femur." Wolcott's studies (67) on the blood supply of the neck of the femur in relationship to non-unions is substantiated by many surgeons. One cannot help but note some observations made by Phemister (50), "that intracapsular fracture of the neck of the femur may, by injury of blood supply, result in aseptic necrosis of a part or all of the head of the femur. This occurrence greatly increases the likelihood of non-union of the fracture. . . . In case of non-union, atrophy of disuse of the living bone develops during the period of immobilization while the dead bone of the head does not atrophy. . . . Connective tissue and blood vessels slowly invade the dead bone which in turn is absorbed and replaced by new bone by the process of creeping substitution."

An interesting observation has been noted by Dalby and his associates (18) regarding the occurrence of fractures of the neck of the femur following irradiation for pelvic malignancy. He reports 14 cases of spontaneous fracture of the neck of the femur following irradiation. The average age of the patients was fifty-seven years and in each case pain antedated the diagnosis of fracture by months. Roentgenograms of the femur were

taken months and even years before the fracture occurred and in no instance was neoplastic growth positively demonstrated roentgenographically at the fracture site. Six patients had no evidence of metastasis at the time of fracture. All patients were re-examined following the fracture and did not show metastasis. Nine of the patients with fractures developed non-union and none of the patients showed any callous formation when observed after ten months or later. Dalby's reasons for these phenomena are highly speculative; present-day roentgen treatment of pelvic malignancy employs a higher voltage than formerly; likewise the amount, intensity, and duration of treatment have increased, so that irradiation may be an important factor in the production of this complication.

CONCLUSION

The conscientious work of these men and their frankness in admitting failure as well as success will lead us to a better understanding of this all-important fracture which in the past has been, as Speed (59) states, "The Unsolved Fracture."

As most of the fractures of the neck of the femur occur in the aged and none of the authors claim power of rejuvenation in their methods, and as few, if any, other bones result in 90 per cent union after fracture, I believe that the "Answer" is not too far distant.

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SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Haggart, G. E.: Sciatic Pain of Unknown Origin. An Effective Method of Treatment. *J. Bone & Joint Surg.*, 1938, 20: 851.

The author presents an effective method of treatment for the relief of sciatic pain, especially applicable in those cases in which the etiology is unknown and in which immediate relief is desirable while attempts are being made to determine the cause. He believes, as does Badgley and Steindler, that sciatic pain is referred from pathological changes in or about the intervertebral foramina, arising from a primary lesion located in the lumbar, lumbosacral, or sacroiliac regions.

Contrary to the treatment of most orthopedic surgeons, Haggart attempts to mobilize his patients as quickly as possible. In the group of 75 cases upon which he reports, he used a combination of the following procedures: (1) perineural injection of the sciatic nerve with novocaine; (2) traction to the affected extremity; and (3) careful manipulation of the low back under pentothal anesthesia.

His objective in the injection procedure is the perineural area of the sciatic nerve as it emerges from the pelvis through the greater sciatic foramen, plus injection of the adjacent fascia and the substance of the pyriformis muscle.

The author determines the point of insertion of the needle by the intersection of a line projected directly lateral from the apex of the intergluteal fold with an imaginary line drawn perpendicularly from the ischial tuberosity. This point is checked further by an imaginary line drawn from the midlateral aspect of the greater trochanter to the spinous process of the fifth lumbar vertebra. This line indicates the extreme lateral boundary of the injection field and usually intersects the other lines at the same point.

A 6-in., 20 gauge needle is then passed medially at an angle of 45 degrees with the skin surface. When the needle strikes the sciatic nerve, which can be identified by the immediate reaction of the patient, it is withdrawn about .5 of a centimeter. Two more needles are inserted, one on each side of the first, into the substance of the pyriformis muscle and the surrounding fascia. Into each needle approximately 50 c.cm. of 1 per cent novocaine mixed with a small amount of adrenalin are injected.

The results were best when the injection was combined with manipulation of the low back under general anesthesia. DANIEL H. LEVINTHAL, M.D.

Geschickter, C. F., and Maseritz, I. H.: Primary Hemangioma Involving Bones of the Extremities. *J. Bone & Joint Surg.*, 1938, 20: 888.

Primary hemangioma of bone is a relatively uncommon lesion. There are 11 reported cases of symptomatic primary hemangioma involving bones of the extremities. Four additional cases are presented. One of these, an angioblastoma in bone tissue, is the first case of its kind to be reported.

Fig. 1. Hemangioma of the humerus.

The youngest patient was eight years of age, the oldest twenty. Three of the 4 patients gave a history of trauma, 2 had had pathological fractures, and a third had received a crushing injury.

The roentgenographic changes of primary hemangioma of bones in the extremities are similar to those of benign giant-cell tumor or osteitis fibrosa cystica. The differential features are that the lesion of primary hemangioma of bone tends to progress and may be more extensive; the locules, when present, are smaller than the lobules of the benign giant-cell tumor or the benign bone cyst. The walls of the locules in a primary hemangioma of bone possess a heavier framework.

Primary hemangioma of bone gives rise to cystic cavities which contain no capsular lining. Like bone cysts, they may contain fluid or tumor tissue

within the wall. The tumor material filling these cavities is apparently similar to the tissue of angiomatous tumors elsewhere.

The microscopic findings in hemangioma of bone presents various features for classification. The 4 new cases presented are classified as: capillary hemangioma, cavernous hemangioma, angioblastoma, and angiosarcoma.

The sections of the capillary hemangioma showed areas of hemorrhage between which were capillaries with their single layers of endothelium and hyaline contents. There were large cystic cavernous spaces filled with red blood cells, occasional lymphocytes, and polymorphonuclear leucocytes. The irregularly shaped sinuses in the cavernous hemangioma contained coagulated material and were lined with endothelium. Definitely formed capillaries and stroma containing young fibroblasts were interspersed between the many channels. The angioblastoma had tortuous tubules which lay in a fibrous stroma. These tubules usually contained a colloid-like material. There was an occasional small capillary. The tissue of the angiosarcoma consisted of many cavernous spaces lined by single rows of endothelial cells and contained deeply staining material. Between these spaces were many small tightly packed endothelial cells which frequently contained a small centrally placed nucleus. These cells were uniform in size and were found to be stained deeply.

Irradiation is the most valuable method of treatment for primary hemangioma of bone. Complete cures have been reported in a number of cases. The value of curettement is questionable. Adequate resection of bone has produced cures.

ROBERT P. MONTGOMERY, M.D.

Moulonguet, P., and Pollosson, E.: Sarcoma of the Muscles and the Surrounding Connective Tissue of the Extremities (Sarcomes des muscles et des coulées conjonctives des membres). *J. de chir.*, 1938, 52: 501.

Moulonguet and Pollosson distinguish the sarcomas of the connective tissue separating the muscles and surrounding the blood vessels and nerves from those of the muscular tissue. In a series of 119 cases, they found 37 cases of sarcoma of the muscles, 43 cases of sarcoma of the connective tissue, and 39 cases in which the records do not indicate clearly the tissue involved. They note that the tumors involving the connective tissues are small and are rarely noticed in their earliest stage; when they become larger, they are rounded in shape and well encapsulated, but the capsule does not prevent the invasion of the surrounding tissues by the malignant cells. The skin covering the tumor is usually normal. In sarcoma of the muscular tissue, the tumor may be encapsulated, but it is more apt to be infiltrating. Such tumors become noticeable at an earlier stage than those of the connective tissue; when the muscle is relaxed such a tumor is movable; but when the muscle is contracted it becomes immovable. The skin above the tumor is usually uneven and discolored—of a violet color. In cases that are operated upon, recurrence usually takes place in or near the scar of the operative wound.

Sarcomas of the muscles and related connective tissues of the extremities may be of various histological types. In their series, the authors found fibrosarcoma to be the most frequent type; it occurred in 38 cases. Liposarcoma was next in frequency (33 cases); angiosarcoma occurred in 16 cases, and rhabdomyosarcoma in 13 cases. Other types were less frequent; in 8 cases the sarcoma was made up of embryonic mesenchyme cells; in 6 cases of giant cells; and in 5 cases of osteoblasts. In the last group the roentgenograms showed areas of calcification, clearly separated from the bone. In 2 additional cases operated upon as sarcoma the histological examination and clinical course showed the tumor to be benign; histologically, these tumors closely resembled myeloplaxoma of bone; they were classified as xanthogranuloma.

Seventy-seven of the 119 patients in the authors' series have died; 11 are living but show a recurrence; 16 have recently been operated upon; and 15 are cured. Four patients were children; of these 2 died, and 2 are living and well seven and nine years, respectively, after the operation.

In the treatment of such cases, a simple excision of the tumor is definitely contraindicated, on account of its definite malignancy. A sufficiently extensive resection with removal of the surrounding tissue is usually impossible. In tumors involving the muscle tissue only, a myectomy may be done, and this may represent a sufficiently extensive resection. Amputation may be done in some cases, but in most instances amputation is done too close to the tumor and there is a recurrence in the amputation stump. In the authors' series, amputation was done in 34 cases, but in most of the cases it was done too late, after repeated attempts at local excision. Disarticulation of the affected limb gives better results; the authors' series included 4 disarticulations at the hip and 2 at the shoulder. In the cases in which radiotherapy was employed, the tumor was found to be radiosensitive, *i.e.*, showing a marked diminution in size and sometimes disappearing entirely (19 cases); but the tumor proved to be radio-resistant in 26 of the cases.

In considering the treatment employed in the 15 cured cases the authors note the following: in 5 cases cure followed local operation; in these cases it is evident that the tumor was of low malignancy. One cure was obtained by treatment with diathermocoagulation with the high-frequency current. In 2 cases cure followed amputation after unsuccessful local operation; and in 2, a primary amputation; a third case may be included in the latter group, as the patient died thirteen years after operation from pneumonia, and death was apparently not due to the advance of the sarcoma. No case of cure can be attributed to radiation alone, but in 10 cases radiotherapy was used as an adjunct to operation; in 2

of these cases the limb was sacrificed (amputation and disarticulation).

In the presence of a small or moderately large tumor of the muscle or connective tissue of an extremity, the authors advise that it should be excised as a form of biopsy, and immediate histological examination made; in large tumors a biopsy specimen should be obtained. Radiotherapy may be tried if the tumor is of a radiosensitive type. The authors have found certain types of angiosarcoma and liposarcoma to be most radiosensitive, but they consider further study of the relation of histological type to radiosensitivity to be most important. However, in many cases sacrifice of the limb, either by high amputation or disarticulation, is definitely indicated. In some cases the most radical operation—interscapulothoracic disarticulation of the shoulder or interilio-abdominal disarticulation of the hip is necessary. ALICE M. MEYERS.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Mondolfo, S.: Resection or Arthrodesis in Tuberculosis of the Knee? (Resezioni ed artrodesi nella tubercolosi del ginocchio?) *Arch. ital. di chir.*, 1938, 49: 241.

The author operated on 65 cases of tuberculosis of the knee performing a resection in 37 and an arthrodesis in 28. In the group treated by resection 51.4 per cent of the cases were operated upon during the period of evolution of the tuberculosis and 48.6 per cent during the regressive period. Good clinical results were obtained in 86.5 per cent and poor results in 13.5 per cent. Of the 28 cases in which arthrodesis was performed 10.71 per cent were operated upon during the period of evolution and 89.19 per cent during the regressive period, with good results in 81.48 per cent and failure in 18.52 per cent.

The author draws the following conclusions:

1. In gonitis with a moderate or slight destruction of the osseous portions, a resection during the reparation period is indicated, after the inflammation has decreased.

2. Resection should be performed also, if possible, during the period of reparation, if the gonitis is responsible for a grave destruction of the osseous portions with formation of sequestra and there is a tendency toward pseudarthrosis.

3. In specific synovitis arthrodesis is indicated during the reparation period. If possible, the intra-articular type of operation is the one that should be selected.

4. In deforming arthrosis resulting from a progressive gonitis arthrodesis is suggested and, whenever possible, the method of Ianas and Mezzari should be chosen on account of its great simplicity.

5. If contraindications to resection exist, the intra-articular method of arthrodesis is preferable to the extra-articular method.

JOSEPH K. NARAT, M.D.

Smith, A. DeF., Butte, F. L., and Ferguson, A. B.: The Treatment of Scoliosis by the Wedging Jacket and Spine Fusion. A Review of 265 Cases. *J. Bone & Joint Surg.*, 1938, 20: 825.

The authors performed fusion in 287 of 1,498 patients with scoliosis which came under their care. The indications for fusion in their clinic were as follows:

1. A curve which is progressing in the growing child.

2. A severe curve with imbalance of the trunk, whether or not the patient is beyond the period of growth.

3. A deformity which is causing pain or fatigue. In some of these cases an operation could be performed without previous correction. The patient was sent first to a special scoliosis clinic where a complete routine history was taken and physical examinations were done, including measurement of the total height, sitting height, and length of the lower extremities. In some cases a study of the vital capacity was made. Roentgenograms were taken in the standing and lying positions.

In those requiring fusion a jacket was applied which was essentially the same as that described by Risser in 1931 with several modifications, namely, that only enough traction was applied to the head to hold it in position and the cast was applied with the head tilted toward the side of the concavity of the curve. The authors point out that the wedging procedure not only corrects the primary curve but also increases the compensatory curve. After the jacket has been removed the compensatory curve straightens in proportion to the degree that the primary curve has been corrected and the body balance is re-established in those cases in which the primary curve is only partially corrected.

The following rules were used to identify the primary curve:

1. When 3 curves are present, the middle one is usually the primary curve.

2. When in the sitting position the pelvis is elevated on the side of the convexity of the lumbar curve, this curve will tend to straighten if it is compensatory.

3. If the curve just described is primary, it remains.

The Hibbs method of fusion was used in all cases and only 5 vertebræ were fused at one time; in this way shock was minimized and the mortality was reduced from 1.9 to 0.66 per cent. Glucose was given intravenously during the operation, and frequently blood transfusion followed the injection.

The patients were kept in bed in the original cast for three months. A second cast was then applied in the position assumed naturally by the patient. A strap of plaster was included over the shoulder opposite the curve in order to hold the neck and head over. After a lapse of three or more months a cast without shoulder straps was applied, with the patient almost completely straight. This was removed after three months, and if the roentgenograms

revealed a solid fusion, no more casts were applied. A loss of 10 per cent of correction occurred in the average case. Greater loss indicated incomplete fusion.

Pseudarthrosis occurred in 61 cases, 47 of which were re-operated upon and the defect was repaired. In some of the later cases the authors supplemented the mass of chips from the lamina with multiple tibial chips.

The results of this treatment were excellent in 79.7 per cent, fair in 15.6, and poor in 4.7.

The authors concluded from their work that the combination of the wedging jacket and fusion is the most effective method yet devised for the correction and maintenance of the correction of lateral curvature of the spine. DANIEL H. LEVINTHAL, M.D.

L'Episcopo, J. B.: Bone Block for Painful Hips. *J. Bone & Joint Surg.*, 1938, 20: 901.

A new operative procedure for the treatment of painful hips is presented. The idea was conceived in 1927 when the graft in an extra-articular arthrodesis failed to unite to the trochanter but firmly attached itself to the ilium. The patient, who had had a painful hip from tuberculosis, was allowed to walk and was found to be free from pain. In 1932, the bone block was intentionally done in a young adult with a painful hip, resulting from changes believed to be subsequent to an untreated slipped epiphysis, and this was followed by relief from the symptoms. Since that time, 15 patients have been operated upon by the following technique:

The hip area and the side of the ilium are exposed by a modified Smith-Petersen incision, the upper arm of the incision being brought well back along the crest of the ilium to expose the crest and the upper portion of the side of the ilium and permit the removal of a good-sized graft. Either a straight or curved graft is removed from the ilium. If there is no protrusion at the outer junction of the head and the acetabulum, a straight graft is stretched across the joint between the ilium and the trochanteric fossa or the greater trochanter. In some cases there is a mass of bone at the acetabulofemoral junction, so that a straight graft does not work satisfactorily. In that case, a curved graft is necessary. The graft should be about 1½ in. wide and sufficiently long to reach between the points of contact which have been previously determined. When measuring for the length of the graft, the surgeon should adduct the thigh, so that after the upper end of the graft is placed in a slot on the side of the ilium, the lower end is jammed tightly against the trochanteric fossa as the thigh is abducted to the straight or neutral position. Care must be exercised to prevent the slightest abduction. In that the graft is firmly pushed into the ilium as the thigh is brought from the adducted to the neutral position, no sutures are necessary to hold it in place. The wound is closed as any similar incision. A hip spica bandage is applied from the nipple line to the ankle. This is changed to a short spica bandage after from six to eight weeks, and the patient is allowed to walk with crutches. Complete weight-bearing is permitted as soon as roentgenographic examination shows union of the graft to the ilium, which is usually after from ten to twelve weeks.

The author has performed this operation in 17 cases: 4 of slipped epiphysis; 3 of congenital dislocation of the hip, in which it was done instead of a shelf operation; 4 cases of tuberculosis; and 6 cases of hypertrophic arthritis. Brief case histories of 13 patients who had been followed up for two or more years since the operation are reported. Of these patients, 8 have been relieved of pain; 3 have been benefited; and 1 has not been benefited. In 1 case the final result is unknown.

It is difficult to explain the rationale. It is the author's opinion that the pain is relieved because the graft takes on some of the weight in walking, and thus relieves the weight-bearing joint surfaces. This theory is supported by the fact that the graft is essentially parallel with the neck of the femur, and it

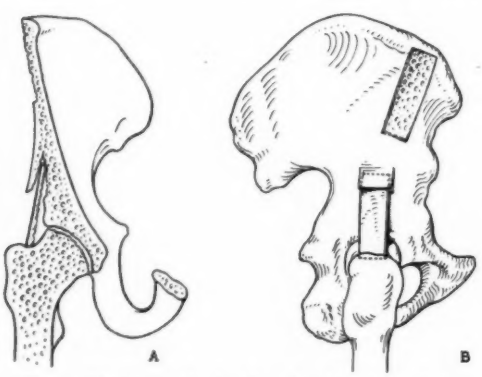

Fig. 1. Diagrammatic drawing showing the technique of the operation when a straight graft is used.

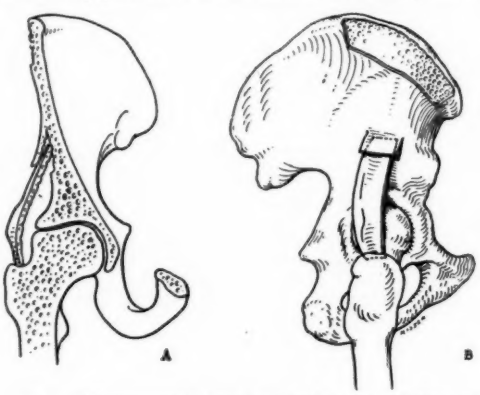

Fig. 2. Diagrammatic drawing showing the technique of the operation when a curved graft is used.

takes up the stress and strain of the neck, as evidenced by the growth of the transplant as time goes on. All of these patients developed an adduction and flexion deformity. He took this as an indication that abduction produces pain and that this development is a protective mechanism, and believes that the operation merely helps nature in this way. He emphasizes that the graft has to be long enough to prevent abduction beyond the neutral position or the operation will be a failure.

PAUL C. COLONNA, M.D.

Haas, S. L.: The Correction of Extreme Flexion Contracture of the Knee Joint. *J. Bone & Joint Surg.*, 1938, 20: 839.

Haas states that the method of correction of extreme flexion deformities of the knee varies with the degree and type of contracture. Lengthening of contracted tendons and severing of the posterior capsule is usually necessary. If there is bony ankylosis, a wedge resection or circular osteotomy is necessary before extension can be started. Once the tissues are freed, extension may be carried out by any of the innumerable recognized methods. Great care must be taken that injury to the large popliteal vessels and nerves be avoided during the surgery or when the knee is being extended by mechanical means.

The author has found the hinged plaster cast to be the most simple and efficient aid in the correction of the deformity, since it not only corrects the flexion deformity, but prevents posterior subluxation during the procedure, and tends to correct the luxation which is usually present. These results are obtained by placing the axis of the hinges anterior to the axis of the knee joint, which produces an anterior thrust on the tibia.

Haas reports 4 cases of severe contracture of the knee joint, 1 of the congenital type, 1 secondary to osteomyelitis of the tibia, and 2 following severe burns. Prior to treatment the patients were unable to walk without some mechanical aid. In all of the cases Haas fulfilled his aim, i.e., he produced a straight, weight-bearing extremity and conserved the extremity. He used the methods described and skin grafts to cover the skin defects produced during the procedure. DANIEL H. LEVINTHAL, M.D.

Levine, M. A.: An Operative Technique for Hallux Valgus. *J. Bone & Joint Surg.*, 1938, 20: 923.

A new operative technique which has been used in 10 cases of hallux valgus is presented. It utilizes the tendon of the extensor hallucis longus as a direct antagonist to the oblique and transverse heads of the adductor hallucis muscle. The articular cartilage of the first metatarsophalangeal joint is undisturbed. Follow-up on one case treated in this manner two years previously revealed a painless joint with full range of motion and no recurrence of deformity. The operative technique is as follows:

Through an S-shaped incision made dorsomedially over the level of the first metatarsophalangeal joint, the bursa and the capsule covering the bony exostosis is exposed. The bursa is partially dissected from above downward, which exposes the dense fibrous capsule of the first metatarsophalangeal joint. Through an H-incision, the parallel cuts being made near its proximal and distal insertions, the capsule is incised and reflected to expose the bony excrescence. This exostosis, together with the medial base of the proximal phalanx, is removed and the surfaces are smoothed. The previously taut capsule is then redundant, and may be imbricated. The flap which previously covered the exostosis is turned laterally and sutured in place. The extensor hallucis longus tendon, inclusive of the paratendon, is then freed and, without disturbing its insertion, is translocated medially to its new bed (Figs. 1 and 2). The remaining flap is reflected medially over the tendon and sutured so as to make a canal. During the entire suturing process, an assistant holds the great toe flexed. The skin is closed and a tongue-blade splint is applied for immobilization of the joint.

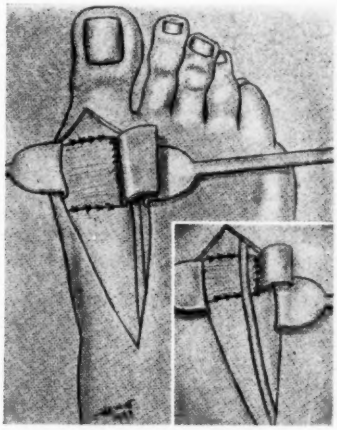

Fig. 1. Fig. 2.

After fourteen days the splint is removed and physical therapy in the form of active and passive motion under water, followed by gentle massage, is instituted. PAUL C. COLONNA, M.D.

FRACTURES AND DISLOCATIONS

Santy, P., Colson, P., Hustinx, E., Topa, P., and Others: Fractures of Both Bones of the Forearm (Les fractures des deux os de l'avant-bras). *J. internat. de chir.*, 1938, 3: 477, 497, 519, 535, 559, 571.

The authors take part in a symposium on fractures of both bones of the forearm.

Santy and Colson believe that these fractures should be treated by open reduction as soon as closed methods have failed. No time should elapse during which large hematomas may form and hemorrhage infiltrate the contiguous muscles. They suggest that during the operation the patient should lie

prone, with the arm resting on a board in 90 degrees of abduction, and the palm of the hand on the table. They believe that with this position both bones can be approached with a minimum of manipulation. In their hands this open method with metal-plate fixation has given the best results.

Hustinx, after an analysis of the fundamental causes of displacements in these fractures, rejects as impractical all forms of extension treatment, whether skin or skeletal. He states, and reports on 85 cases to substantiate his claims, that if manual reduction with plaster immobilization fails, an open operation with metal plate fixation should be done.

Topa, after studying 26 cases, states that in no other fracture is exact anatomical reposition so important. A vicious callus is the dreaded complication which will limit the rotatory action of the forearm, and this can best be avoided by accurate approximation of the fragments. He prefers to use an intramedullary bone graft with a Jacoel-Dujarier clasp (a form of staple) which is removed about three weeks after the operation.

Stulz and Jung support the other authors who feel that an open plating operation should be done when the preliminary closed procedure has failed.

Iacobovici, from a somewhat limited experience, states that he has had occasion openly to reduce and plate 4 cases with excellent results.

Griswold prefers a closed reduction with an apparatus which exerts traction on the extended fingers by means of metal spring traps, and, with the elbow at right angles, counter traction against the anterior surface of the arm. This reduction is accomplished under fluoroscopic or roentgen-ray control, and plaster fixation is used after the reduction is seen to be satisfactory. In the application of the plaster, dowel pins are placed over the interosseous space in order that the plaster is molded down between the bones. Griswold does not speak of the percentage of failures, or how many cases came to open reduction. JAMES K. STACK, M.D.

Logròscino, D.: Biological Resources of the Proximal Fragment in Fractures of the Neck of the Femur (Le risorse biologiche dell'epifisi femorale superiore fratturata). *Chir. d. organi di movimento*, 1938, 23: 551.

In young adults and in adults not too advanced in age the proximal fragment remains alive frequently up to five years after the fracture of the neck of the femur. In the aged or in debilitated individuals, the proximal fragment remains alive only if the trauma has spared some of the nutrient vessels, or if revascularization has occurred. Similarly, as in cases of osteochondritis dessicans, the synovial fluid serves for a period of time to nourish the proximal fragment. If during this period of time the fracture is adequately opposed and held in reduction mechanically, this fragment may actively participate in the process of repair.

The author presents in detail 2 cases of his own in patients aged seventeen and twenty-two, respectively, and reviews 3 other cases from the literature in patients aged thirty, thirty-two, and forty-two years, respectively. A brief discussion is presented with regard to factors which influence the revascularization and sustained viability of the proximal fragment. CARLO S. SCUDERI, M.D.

Browder, N. C.: Nailing the Fractured Neck of the Femur with the Aid of the Fluoroscope. *New England J. Med.*, 1938, 219: 296.

The immediate treatment for fractures of the femoral neck advocated by the author is the administration of morphine and atropine, and manual traction plus internal rotation, followed by the application of adhesive traction on the lower extremities and a Thomas splint with from 5 to 8 pounds pull on the affected side. These procedures will lessen the shortening, stop hemorrhage, and mitigate shock, pain, and muscle spasm.

The ideal time for the operation is on the second or third day after the fracture. Pre-operative barbiturates and morphine are contraindicated because they increase the possibilities of cardiac decompensation and pneumonia. Fifty mgm. of novocaine and 5 mgm. of pontocaine are given as a spinal anesthetic. Local anesthesia is not used because it takes longer to become effective, does not give complete muscular relaxation, adds more fluid to the operative field, and does not prevent pain when the nail is driven into position.

Reduction of the fracture should be gentle. A forceful manipulation increases hemorrhage, injures the soft tissues, and may cause shock and death. The maneuvers used for the reduction of the fracture are modifications of Leadbetter. The surgeon stands at the outer side of the injured leg, grasps the front of the ankle with one hand, and flexes the knee to a right angle over his forearm. The hip is then flexed to a right angle and externally rotated while traction is applied. Held in this position the lower extremity is carried inward toward the other leg until the surgeon's hand on the ankle has passed over the uninjured leg. With traction sustained the injured leg is gradually rotated inward and extended until it lies on the fluoroscopic table in 15 degrees of internal rotation. The hip is then abducted 20 degrees and held in this position by an assistant who applies traction force throughout the operation except while the lateral-view roentgenograms are being taken following the insertion of the Kirschner wires and at the conclusion of the operation.

Only an anteroposterior view is taken immediately following the reduction. Reduction is also checked, however, by measurements for shortening and with the fluoroscope. The hip area is prepared and a 3/32-in. Kirschner wire is drilled through the femoral neck to within 1 cm. of the cartilaginous surface of the head as guided by the fluoroscope. A second wire is inserted in a similar manner and the one in satisfactory position is allowed to remain as a guide for the flanged nail. The length of the nail to be used is determined by a Kirschner wire of the same length

which is pushed down to the bone through the opening out of which projects the guide wire. The second wire will protrude beyond the guide wire by the same distance as the length of the guide wire within the bone. A nail 0.5 cm. shorter than this is chosen to allow for shortening by impaction.

A 2 cm. incision is made through which the nail is pushed down to the bone. It is then driven into within 1 cm. of the articulating surface of the femoral head as shown by the fluoroscope. Anteroposterior and lateral roentgenograms are taken immediately following the operation, but lateral views should not be repeated with the leg in the "frog position" for several months because this position tends to loosen the nail.

The patient is allowed to sit in a chair on the third postoperative day if the pain has subsided. A Thomas splint and crutches are used during the first two or three months. The Thomas splint is used for a total of four or six months after the operation, following which crutches are again used until the eighth to the tenth month. The results in 53 cases treated between June, 1935, and April, 1938, serve as the bases of this report. Perfect reduction was obtained in 49 cases. The end-results in the 42 patients who survived the operation and postoperative complications are reported as follows: excellent functional results in 24, fair results in 13, and poor results in 5.

The patients were up with crutches on an average of seventeen days, out of the hospital on an average of thirty-seven days, and bearing their full weight on an average of nine and four-tenths months.

ROBERT P. MONTGOMERY M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Reid, M. R., and McGuire, J.: Arteriovenous Aneurysms. *Ann. Surg.*, 1938, 108: 643.

In 1925 Reid published a series of four articles on arteriovenous aneurysm, in which the literature of the subject was rather extensively reviewed. The view was expressed that there was no essential difference, except in the size and number of arteriovenous fistulas, between angiomas, cirsoid aneurysms, and arteriovenous aneurysms. In this report the authors present another series of cases (30) and discuss their clinical observations and surgical procedures. None of the 12 cases reported in detail in this article has ever been published before.

An analysis of 21 cases of arteriovenous and 9 cases of cirsoid aneurysms is presented, which is supplemented by observations upon experimentally produced arteriovenous aneurysms in dogs. Sixteen of the arteriovenous aneurysms were operated upon and all of them, except 1 case of pulsating exophthalmos, were cured. In 2 instances the aneurysms healed spontaneously without operation. Four patients failed to return for later operations and could never be traced. All of the 9 cirsoid aneurysms were operated upon; 3 were cured and the 6 others were more or less improved. There were no deaths in the entire series of 30 cases.

Clinical and experimental observations which may throw some light upon the physiological and pathological effects of arteriovenous fistulas are discussed in some detail. The principal effects noted and studied were: 10 instances of cardiac damage; 11 instances of thinning and dilatation of the proximal artery; changes in the circulation time in 6 patients; changes in the blood volume in 3 patients; 10 instances of Branham's bradycardiac phenomenon; 13 instances of blood-pressure alterations; changes in the venous blood pressure of 9 patients; 9 instances of markedly increased collateral circulation; 5 instances of impairment of the circulation peripheral to the fistula; 5 instances of an increase in the size and length of an extremity; 4 instances of associated nerve paralyses; 2 instances of double arteriovenous fistula; and 2 instances of spontaneous healing of the aneurysm.

In their clinical and experimental observations, the authors could not confirm Holman's findings of a marked increase of the total circulating blood. A venturimeter was used in some of the experiments to measure the flow of blood in a segment of the vena cava. The writers present an easy method of making an arteriovenous fistula which can be alternately closed and opened.

Unless immediate or early operations are required because of hemorrhage, dangerous hematoma or infection, or rapid cardiac damage, the authors believe it wise to postpone operation for from three to six months after the occurrence of the fistula. During this period, hemorrhage becomes absorbed, tissues are restored to normal, danger of infection is lessened, and the collateral circulation becomes so extensive that there need be no hesitancy to sacrifice the involved vessels at the time of operation. During the period of time that operation is being delayed, more effort should be made to improve the chances of spontaneous healing. A long period of rest in bed with elevation of the affected part and limitation of the fluid intake, and possibly bleeding soon after the accident, might result in more spontaneous cures.

The essential thing in the operative cure of arteriovenous and cirsoid aneurysms is the elimination of all possibilities of any blood ever again passing though the fistulas. To close a fistula with restoration of the vein and artery would appear, at first thought, ideal and physiological. However, in many cases closure has been followed by serious pulmonary complications, due to embolisms of air and blood clots from thrombosis at the site of operation. The ligation of the involved veins probably results in a better balance between the arterial and venous beds, even though the artery is restored.

When the arterial wall is not atrophied and no danger is anticipated from a sudden restoration of the normal blood pressure, suture of the fistula with restoration of the artery and ligation of the vein may be done. In the late cases in which severe changes have occurred in the proximal artery and there is abundant collateral circulation, the authors do not believe in an attempt to restore the artery. The quadruple ligation of the artery and vein is certain of succeeding only when all the intervening branches are ligated; otherwise, the chances of the return of the aneurysm to its previous state are excellent. To ligate the canal of communication is probably dangerous and is rarely possible technically.

Whenever possible extirpation of both vein and artery at the site of fistula with quadruple ligation of the vessels was done. There were exceptions to this procedure in the cases of intracranial arteriovenous aneurysms and certain cirsoid aneurysms. Dissection and ligation without a tourniquet is the best choice.

An effective method of assuring the closure of the fistula when the hazards of total ablation appear to be too great is the ligation and division of the involved vessels and transfixion occlusion of the fistula. This procedure was employed in 2 cases and its steps are illustrated.

A new procedure, discussed by the authors, and effectively employed in 2 cases, is the closure of the fistula by means of division and twisting of the vein. Its steps are illustrated. This technique of operation appears to have a definite application in some of those cases in which it is not possible to use any of the other standard, curative procedures.

In general, any procedures which do not actually close the fistula are undesirable and may not only fail to cure the aneurysms, but may cause serious circulatory disturbances peripheral to the fistulas. An untold number of limbs have become gangrenous and have had to be amputated because of the simple proximal ligation of the artery. There are some abnormal arteriovenous communications, however, for which it still seems necessary to take the risk of performing a proximal ligation of the artery.

HERBERT F. THURSTON, M.D.

RETICULO-ENDOTHELIAL SYSTEM

Robb-Smith, A. H. T.: Reticulosis and Reticulosarcoma: A Histological Classification. *J. Path. & Bacteriol.*, 1938, 47: 457.

The author presents a classification of the progressive hyperplasias and neoplasias of lymphoreticular tissue which follows Maximow's hypothesis of the pluripotency of certain primitive cells of the embryonic mesenchyme which persist throughout life.

In his introduction he puts forward a justification for a methodological consideration of the lymphadenopathies. Upon such a framework as he proposes a clinical analysis can be superimposed and search made for causative factors. Further subdivisions may be necessary or certain of those put forward may prove superfluous, but with a classification based on cytology and structure such adjustments are possible without destruction of the main concept. It is only by uniformity of description and a scrupulous use of terms that any advance can be made.

The normal anatomy of the lymph node is described and a classification of the reticuloses presented. Reticulosis is defined as a progressive hyperplasia of reticular tissue with differentiation of one or more cell types. Follicular reticulosis is the hyperplasia of undifferentiated cells in lymph follicles and malpighian bodies of the spleen with the possible reproduction of the follicular structure in the bone marrow and periportal tissue. Sinus reticuloses consist of the hyperplasia of undifferentiated mesenchymal cells and littoral cells in lymph sinuses, sinusoids of the liver, and venous sinuses of the spleen and bone marrow. In some cases tissue histiocytes are also involved. Medullary reticuloses are the hyperplasia of undifferentiated mesenchymal cells in the medullary tissue or pulp of the lymph node and spleen, in the periportal tissue of the liver, and possibly in the interstitial tissues throughout the body. In any of these conditions free cellular elements may appear in the circulating blood. The classifications with their subdivisions are presented for these reticuloses.

In the consideration of reticulosarcoma, the criterion employed by the author is that this lesion is a proliferation of mesenchymal cells or of their progeny, which results in stromal destruction as well as infiltration. After examining a number of tumors of reticular-tissue origin, he found that the blastomas could on the whole be classified satisfactorily on the basis of their cytological differentiation. The classification suggested by the author is as follows:

A. Undifferentiated reticulosarcoma (syncytial)
   1. Diffuse
   2. Trabecular (stroma reaction)
B. Differentiation to histioid cells
   1. Dictyosyncytial (fibrillosyncytial) reticulosarcoma
   2. Dictyocytic (fibrillary) reticulosarcoma
C. Differentiation to hemic cells
   1. Lymphocytoma
      a. Lymphoblastic sarcoma
         (1) Medullary
         (2) Follicular
      b. Lymphosarcoma
   2. "Plasmocytoma"
   3. (Monocytoma)
   4. Myeloblastoma
   5. Erythroblastoma
D. Mixed type (polymorphic reticulosarcoma)
E. Differentiation of sinus lining cells
   1. Undifferentiated cell type (reticulo-endothelio-sarcoma)
   2. Differentiated cell type (histiocytoma)

The author notes that since Gordon's original account of the production of a peculiar form of ataxic paraplegia in rabbits following the intracerebral inoculation of lymphadenomatous material, numerous investigators have confirmed its value in the diagnosis of Hodgkin's disease and the consistency with which control lymph nodes give a negative result. The carrying out of the biological test is simpler than a careful histological examination of a lymph node, but it should aid histological diagnosis and not replace it. In the majority of cases, a histological diagnosis of Hodgkin's disease is not difficult. The main difficulty arises in the distinction between a polymorphic reticulosarcoma and Hodgkin's disease, and it is here that the biological test is of great value. It has constantly been found that polymorphic reticulosarcomas give a negative reaction even when they resemble Hodgkin's disease very closely histologically.

HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Nylin, G.: The Practical Applicability of the Cardiopulmonary Function Test. *Acta med. Scand.*, 1938, Supp. 93.

The author uses the term "cardiac insufficiency" synonymously with "heart failure." By decompensation he means congestive heart failure. Schematically, two stages of heart failure are described:

Stage I, or the latent stage, during which the patient in the resting condition does not show any signs of insufficiency.

Stage II, in which there are typical symptoms of insufficiency in the resting condition, which imply congestive phenomena characterized by venous engorgement, cardiac enlargement, dyspnea at rest, edema, and cyanosis.

Stimulated by the investigations of various workers in the determination of "latent cardiac insufficiency," the author has worked out a method for the determination of the increased oxygen consumption after work. A specially constructed staircase was used for the work in function tests. The oxygen consumption was determined during rest and at a certain fixed time after cessation of work. The increase was then expressed as a percentage of the resting value, and this was taken as the basis for estimation of the dyspnea and also the function of the cardiopulmonary system. By the study of a large number of individuals including healthy persons, as well as patients with compensated and decompensated heart conditions, it was found that the patient with cardiac insufficiency had a larger oxygen consumption than the healthy person at a certain fixed time after the cessation of graduated work.

The practical applicability of the cardiopulmonary function test is discussed in cases of valvular disease, coronary artery disease, and pulmonary diseases. The author's apparatus and method for this test are described in detail and illustrative cases are reported. The author has assembled in this work a number of cases in which clinically provable symptoms of insufficiency during rest were usually absent, yet by means of the cardiopulmonary function test, latent cardiopulmonary insufficiency was demonstrated.

SAMUEL H. KLEIN, M.D.

Chalier, A.: The Prevention and Abortive Treatment of Postoperative Phlebitis (La prévention et le traitement abortif des phlébites post-opératoires). *Presse méd.*, Par., 1938, 46: 1345.

Postoperative phlebitis occurs most frequently in obese women over forty years of age who have glandular or cardiorenal disturbances, low blood pressure, a defective venous circulation, and increased viscosity and coagulability of the blood, in which there is alteration due to repeated hemorrhages or a dysfunction of the liver.

The author recommends the following pre-operative prophylactic precautions:

1. Unless the patient has fever and infection, she should move around as much as possible before the operation, and if she has been confined to bed, she should, if possible, get up and walk for a few hours every day.

2. The blood pressure and the number and rhythm of cardiac pulsations should be recorded, and a corresponding treatment of hypoplasia, tachycardia, and arrhythmia, with an adrenaline, ephedrine, or digitalis preparation, should be instituted.

3. Unless absolutely necessary, no drugs accelerating blood coagulation should be administered, and, if the coagulation time is shortened, hirudin and sodium citrate should be given or at least kept at hand to be used after the operation.

4. The organism should be prepared to fight the infection by means of injections of propidon or the daily ingestion of septazine or rubiazol.

As to the operation itself, it should be performed in such a manner that all rules of asepsis are strictly observed, hemostasis is perfect, traumatism of the pelvic veins is avoided, and no large portions of tissues are ligated. The type of anesthesia, the mode of hysterectomy, total or subtotal, and the employment of drainage are of minor importance.

After the operation the patient should leave her bed as soon as possible and in 9 cases out of 10, no matter what the character of the intervention has been, the confinement to bed must not last more than forty-eight hours.

The condition of the pulse is of a greater diagnostic and prognostic value than the temperature. The blood pressure and coagulation time should be determined at frequent intervals to disclose the necessity, if any, of the application of leeches, anticoagulants, and cardiac stimulants.

The abortive treatment consists of the following measures:

1. The continuation and intensification of walking, contrary to the classical treatment. This applies to patients in whom menacing signs, such as acceleration of the pulse, elevation of the temperature, and pains or swelling of the calf or foot have been noticed. In order to facilitate the walking and to attenuate the pains, a gauze bandage is applied to the calf in the upward direction before the patient leaves her bed. During the night hot compresses are applied to the leg.

2. Raising of the foot of the bed to facilitate the flow of the venous blood.

3. The administration of cardiac stimulants and pressor substances.

4. The administration of large doses of anticoagulants, such as from 4 to 6 gm. of sodium citrate or hirudin. The author places 2 or 3 blood leeches on the thighs close to the inguinal region, daily or every second day. The employment of the treatment outlined for ten years enabled the author to avoid the development of phlebitis with all its sequelæ. Among 200 patients who had been operated upon, 50 showed signs of an incipient phlebitis, the evolution of which was stopped by the abortive treatment. The complication did not prolong the duration of hospitalization and did not retard the convalescence. The method is efficient only if used as soon as possible after the detection of the first symptoms, and is not recommended by the author if the condition has not been recognized early enough or if it involves the entire lower extremity. JOSEPH K. NARAT, M.D.

ANESTHESIA

Thomas, G. J.: Technique of Intubation Anesthesia with Detailed Illustration. *Anes. & Anal.*, 1938, 17: 301.

Endotracheal and intratracheal are two terms identifying the same type of anesthesia. It is suggested that the word endotracheal be used for that type of anesthesia in which the tube is passed through the nose and into the upper part of the trachea; and the word intratracheal for that type in which the tube is passed through the mouth and into the middle of the trachea. This type of anesthesia is useful in intrathoracic operations; operations about the head and neck in general; intra-oral operations, such as excision of the tongue, and removal of the lower jaw and cleft palate; operations on the trachea and larynx; in cases in which vomitus may collect in the upper air passage, as in emergency operations for intestinal obstruction; in prolonged operations; and in cachectic individuals. Shock appears to be rare in patients anesthetized by this method. This anesthesia is also useful in orthopedic and neurosurgical procedures, both to maintain anesthesia and an adequate airway when the patient is in the prone position. It is indicated especially for tonsillectomy on an obese patient who possesses a small mouth, deep pharynx, and large tongue.

This type of anesthesia should not be used in poor risks; in cases in which instrumentation and trauma may be a hazard; in acute inflammatory or suppurative disease or in cases with growths in the larynx or other surrounding tissue; in toxic thyroid disease, except when pressure upon the trachea causes respiratory embarrassment; and in conditions in which deep anesthesia is contraindicated as deep anesthesia is needed for intubation.

Premedication with a fair dose of atropine administered about thirty minutes before induction of the anesthesia is desirable. In neurosurgical cases in which the vital centers are depressed because of increased intracranial pressure, it is advisable to omit opiates and barbiturates. When contraindications are absent, morphine with either atropine or scopolamine should be given forty-five minutes before operation. Recently a basal dose of avertin thirty minutes before operation in addition to morphine and atropine was administered. Preliminary cocainization is unnecessary. The patient is anesthetized to the stage in which the mandible is relaxed. The head is extended and a well lubricated Magill curved rubber catheter (sizes from 22 F to 30 F) is passed along the floor of the nose close to the septum. When a point is reached where the respiratory sounds are heard with maximum intensity the tube is inserted onward only during inspiration. If the tube is in the trachea breath sounds will be audible at the outer end. In some instances it may be necessary to use a tongue depressor, exert traction on the tongue, or employ forceps with the aid of a laryngoscope to assist in the placing of the tube into the trachea (Fig. 1).

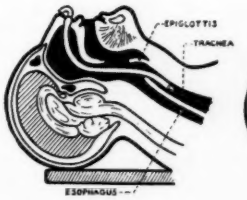

Fig. 1.

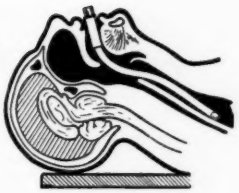

Fig. 2.

Fig. 1. Magill tube in proper position, using the intranasal intubation. Note metal elbow at proximal end of tube. This adapter is used to keep the tube from traversing into nose beyond reach for extubation. It also can be used to attach to anesthetic equipment.

Fig. 2. The intratracheal tube in proper position in the trachea.

For oral intubation deep anesthesia is necessary. Suction is employed to remove mucus from the pharynx. A mouth gag prevents biting of the tube. A laryngoscope is passed until the epiglottis is in view. The lubricated intratracheal tube is then passed without force through the vocal cords (Fig. 2). Apnea may last for from twenty to thirty seconds, after which breathing is quiet.

For simple intubation it is essential that there be good muscular relaxation. The tube should be well lubricated and of proper size. Every apparatus should have a safety or blow-off valve to act as a safeguard against temporary or prolonged overpressure which might injure the lung. Trauma to the teeth, pharynx, and larynx should be avoided. Extubation should be done gently. Under light anesthesia laryngospasm may make removal of the tube difficult. Deeper anesthesia should be induced before an attempt is made to remove the tube in such instances. MANUEL E. LICHTENSTEIN, M.D.

Lorhan, P. H.: The Determination of Acetone in Expired Air: Its Value in Anesthesia and the Surgical Patient. *Anes. & Anal.*, 1938, 17: 316.

Using the Roth method for the determination of acetone in the breath, the author studied a series of

92 patients for postoperative acidosis. The patients included in this series had been operated upon for various conditions, and several different types of anesthesia had been employed.

The following are the author's conclusions:

1. Patients undergoing emergency operations develop acetone in greater amounts and more often than those submitting to elective surgery.

2. Children are more prone to develop acetone than adults, and females more prone than males.

3. Acetone develops oftener and in greater amounts after the administration of anesthesia in which ether has been used than following straight nitrous oxide-oxygen.

4. Trauma is a marked factor in the production of acetone. This was noted especially in the patients who underwent intraperitoneal surgery, while in those undergoing extraperitoneal surgery, the development of acetone was decreased.

5. A simple remedy for the prevention of acetone is the pre-operative administration of fruit juices with glucose solution. After operation the administration of 5 per cent saline-glucose solution will reduce the amount of acetone present; and if acetone remains marked after twenty-four hours the intravenous injection of 50 c.cm. of 50 per cent glucose solution is usually remedial. This treatment may be repeated twelve hours later if necessary. In children glucose may be supplied in the form of hard candy which is usually enjoyed and very well tolerated.

6. The general condition of surgical patients improves much more readily if the production of acetone can be prevented or kept negligible in amounts.

SAMUEL H. KLEIN, M.D.

Bollman, J. L., Svirbely, J. L., and Mann, F. C.: Blood Concentration Influenced by Ether and Amytal Anesthesia. *Surgery*, 1938, 4: 881.

The dilution of the corpuscular elements of the blood during sodium-amytal anesthesia is produced by the abstraction of red cells from the circulating blood by the spleen and by an increase in the fluid of the plasma. In the absence of the spleen, the dilution of the plasma is of similar magnitude as in the intact animal. Ether anesthesia produces an increase in the total circulating red cells, apparently by extrusion of these cells from the spleen and also by diminution of the volume of circulating plasma. In the absence of the spleen, fewer cells are added to the circulation, but the reduction of plasma volume seems independent of the spleen. It was obvious in a number of experiments that the volume of circulating plasma and cells may be altered by capillary beds other than those of the spleen.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Grilli, A.: The Roentgenological Aspect of Beginning and Advanced Gas Gangrene (L'aspetto radiologico della gangrena gassosa iniziale ed avanzata). *Radiol. med.*, 1938, 25: 843.

Roentgenological examination in beginning cases of gas gangrene is valuable because it reveals signs of the disease before crepitation is found. In order to demonstrate the presence of gas, bandages and appliances which may prevent distinct visualization of the soft parts must be removed from the extremity. The roentgenological aspect of gas infection is characteristic and varies according to the tissues which are invaded; an alveolar and reticular appearance is found in the connective tissue, thin longitudinal streaks in the interstices of the muscles, and striations reproducing the muscular fibers in the muscle itself (Fig. 2); in gaseous phlegmon there are an accumulation and superimposition of gaseous bullæ. The development of experimental gas gangrene has been divided into three stages: (1) muscular swelling with a clear zone of irregular contour along the infected tract; (2) diffusion of gangrene with the presence of gaseous streaks indicating the fascicular structure of the muscle; and (3) enlargement of the clear spaces and the presence of large gaseous bullæ with irregular contours in the individual muscles.

Grilli reports 3 cases of gas gangrene studied roentgenologically. In the first case, in which a complicated fracture of the left tibia and fibula resulted from an automobile accident, crepitation was discovered in a limited part of the anterior aspect of the lower third of the left thigh, and roentgenological examination disclosed the presence of a circumscribed collection of gas, resulting from the confluence of rather large bullæ, and of smaller round and isolated bullæ above and below the principal collection. These findings indicated the possibility of incipient gas gangrene. No sign of infiltration of air or gas was found at the site of fracture or in the soft tissues below the patella (Fig. 1). High amputation of the thigh saved the patient's life.

The 2 other cases of gas gangrene were fatal and occurred in soldiers who sustained bullet wounds of the calf of the leg; they presented the typical roentgenological appearance of gas gangrene previously described. It is to be noted that in both cases there was an ordinary bullet wound involving only the soft tissues and that, although no arteries were severed, the circulation of the foot and of the lower part of the leg was blocked by the gaseous distention of the extremity.

In advanced cases, all the soft tissues of the various planes of the extremity are infiltrated with gas; in less advanced cases, the infiltration is limited to the muscles of certain aponeurotic compartments. The infiltration follows the anatomical routes. In roentgenological examination, gas collections in a wound may be distinguished from air collections, since the latter appear as large collections without internal structure and show no spreading around the collection, as denoted by the absence of small peripheral bullæ. Negative images of short duration may be caused by irrigation with hydrogen dioxide. Roentgenological examination is indicated in all cases in which gas gangrene is suspected; it reveals the extent of the infiltration and furnishes the necessary surgical indications within a few minutes and without the necessity of special technical refinements.

Fig. 1.

RICHARD KEMEL, M.D.

Ciurlo, L., and Oliveri, A.: The Technique and Results of Roentgenography of the Larynx in Anteroposterior Exposure (Tecnica e risultati della radiografia del laringe in proiezione anteroposteriore). *Radiol. med.*, 1938, 25: 834.

The authors recommend the method of roentgenography proposed by Réthi in 1914, which consists of the introduction of the roentgen film into

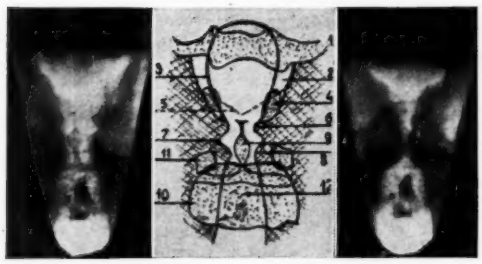

Fig. 1. Fig. 2.

Fig. 1. Anteroposterior roentgenogram of normal larynx with open glottis: (1) hyoid bone; (2) piriform recess; (3) epiglottis; (4) arytenoid eminence; (5) upper margin of the thyroid cartilage, anterior wall; (6) ventricular folds or false vocal cords; (7) Morgagni's ventricle; (8) vocal cords; (9) intermediate calcified portion of the thyroid cartilage (compass needle); (10) shield of the cricoid; (11) base of the arytenoid; and (12) subglottic plane.

Fig. 2. Roentgenogram of the same subject as in Figure 1, with closed glottis.

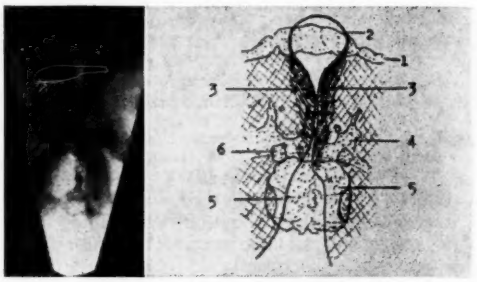

Fig. 3. Extensive tuberculous infiltration of the larynx with nearly complete stenosis: (1) hyoid bone; (2) epiglottis; (3) endolaryngeal infiltrative process; (4) thyroid cartilage largely calcified; (5) shield of the cricoid with its ring; and (6) base of arytenoid.

the hypopharynx in order that roentgenograms of the larynx may be obtained. On a model made of aluminum measuring 9.5 by 4 cm., the sides of which fall away to form a rounded extremity after a straight course of 3.5 cm., they cut the roentgen film to size in the dark room and place it into an appropriate black paper envelope, together with a piece of tin foil on the back of the film to obtain reinforcement of the image. The upper angles of the film are rounded to facilitate removal from the pharynx, and the left angle is cut down more than the right to make recognition of this side easy. A thin layer of paraffin is applied to the envelope to insure impermeability. The hypopharynx of the patient is anesthetized by the use of an atomizer containing the usual 5 per cent cocaine or 2 per cent percaine solution; the patient is placed in the supine posture with a cushion under the shoulders to extend the neck, and the film is introduced as low as possible in the hypopharynx by means of forceps, care being taken to maintain the film exactly transverse to the larynx. Soft rays are used to obtain good roentgenograms; from 42 to 46 kv., 60 ma., 40 cm. focus distance, and an exposure time varying between two-tenths and one-twentieth of a second are used.

It is evident that all the laryngeal components cannot be demonstrated on a single roentgenogram of an individual patient; especially the cartilaginous parts are not apparent unless they are calcified. However, the study of various roentgenograms of different subjects will permit the identification of all laryngeal parts, whether they are cartilaginous or musculomembranous. Pictures obtained in pachydermia of the larynx with eversion of the ventricles, in tuberculosis of the larynx, and in paresis of the abductors are presented for comparison with those of a normal subject, aged twenty-eight years, showing the phases of open and closed glottis (Figs. 1 and 2). In this subject, the cricoid cartilage and the intermediate part of the thyroid cartilage between its two lateral portions are already calcified, and part of the lower margin of the thyroid cartilage and the bases of the arytenoids can be recognized, as well as the thyrohyoid ligament, the piriform recesses, the epiglottis, the arytenoid eminences, the ventricular folds, Morgagni's ventricles, and the vocal cords. In the case of a patient who has proliferating laryngeal tuberculosis with nearly complete stenosis due to invasion of the supraglottic and glottic planes by the specific process, the entire cricoid cartilage is visible because it is completely calcified, while the thyroid cartilage is only partially visible and the bases of the arytenoids are hardly demonstrable (Fig. 3). RICHARD KEMEL, M.D.

Maingot, G., and Bernard, E.: Research of the Pulmonary Cavities by Tomography (A la recherche des cavernes pulmonaires par la tomographie). *Arch. méd.-chir. de l'appar. respir.*, 1937, 12: 425.

It is a well known fact that the ordinary flat plate roentgenogram of the chest does not always reveal all which one might desire. An x-ray of the chest is really a superposition of images situated in the different planes. The images are made up both of physiological and pathological factors: the clavicles, the scapulas, the ribs, the spine, the heart, the liver, and other viscera are all combined in the physiological images. Many times there are homogenous shadows in the midst of which a cavity cannot be isolated, analyzed, or even suspected.

There are 2 types of lesions which are recognized: (1) those in which multiple spots give an impression of a diffuse infiltration, and (2) those in which a uniform density gives the impression of either a pleural effusion or a fibrothorax.

The new method is known as tomography. This method permits the identification of a thin section of the thorax wherein only the images situated in that

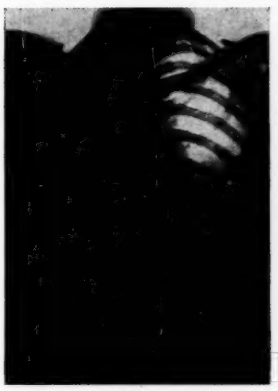

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. Radiography. Fig. 2. Tomography at 6 cm. on dorsal plane. Fig. 3. Tomography at 9 cm. on dorsal plane.

focal plane have a clear or distinct representation. Using this method one is able to make a number of sections at different levels.

Six cases are discussed in detail. In each case the ordinary flat plate roentgenogram is first considered; then the tomographic sections taken at the levels as indicated are considered and discussed and are found to bring out the pathological lesions quite clearly.

In the first case presented, the ordinary roentgenogram of the chest showed the cardiopericardial shadow contracted to the right. The right side of the chest showed a uniform density equal to that of the liver through which it was impossible to diagnose adjacent pathology. It was therefore impossible to recognize the outline of the suspected cavities in the right apex.

A study of the tomographs taken at the 6, 9, 12, and 15 cm. levels is discussed. The section taken at the 9 cm. level showed two distinct cavities, the pathology of which was much more thoroughly outlined than in the ordinary roentgenogram of the chest.

Tomographs are especially valuable for selection of the treatment. In particular they are of great value in the determination of the depth and size of the cavities in question, and of whether or not adjacent cavities are separated by good pulmonary tissue.

Tomography is a procedure by means of which localization may be carried out in the depth of the tissue. The tomograph literally cuts the thorax at the desired level. Each of the sections is fixed with relation to the frontal plane of the subject.

The authors are of the opinion that another great step has been made in the method of diagnosis of chest lesions. They suggest that the physical signs as brought out by inspection, palpation, percussion, and auscultation have been enhanced further by flat roentgenography of the chest. Now the latest development and advance in chest work, they believe, is tomography, which presents great possibilities of bringing into evidence lesions which heretofore have not been suspected. The method has not been perfected as yet and much remains to be done in this very valuable work. RICHARD J. BENNETT, JR., M.D.

Bullo, E.: Roentgenological Changes of the Mucosa in Neoplasms of the Stomach (Le alterazioni radiologiche della mucosa nelle neoplasie dello stomaco). *Tumori*, 1938, 24: 407.

The studies of Forssell have shown that the formation of gastric folds is due to the contraction of the muscularis mucosæ, the degree of imbibition of the mucosa, and the contraction of the muscular layer itself. The presence of gastric folds is best demonstrated by the use of a small quantity of opaque solution, which causes the appearance on the roentgenogram of alternating clear and dark lines of varying aspect according to the part of the stomach under consideration. The folds along the middle portion of the lesser curvature and of the anterior and posterior walls run parallel to the axis of the stomach and are straight or slightly wavy, while most of the folds at the beginning of the antrum run perpendicularly or obliquely to this axis, arriving at the greater curvature; a few in the proximity of the lesser curvature run parallel toward the pylorus. The folds present a reticular aspect over the fundus. In the roentgenological evaluation of the mucosal relief, the elasticity, size, course, continuity, and disposition of the folds must be taken into consideration, as well as the changes produced by posture, compression, degree of filling, and superimposition of the anterior and posterior walls.

The changes in size, elasticity, and course of the gastric folds constitute the basic signs which permit recognition of alterations in the mucosa, and palpation under the roentgenoscope in cases of hardness

Fig. 1. Prevailingly vegetating carcinoma, with superficial ulceration of the neoplastic tissue, which recalls the image of a niche.

Fig. 2. Small polyp of the prepyloric region, with well defined contour and regular conservation of the folds around it.

and rigidity of the folds is a valuable help. In carcinoma, the degree of integrity of the mucosa will serve to distinguish ulcerating from non-ulcerating tumor, but the mucosa does not always present a typical relief for each form, and various combinations may be encountered. In vegetative carcinoma, the normal design of the folds disappears and is replaced by transparent areas cut up by irregular folds with spots that recall grossly the aspect of a niche (Fig. 1). At times, through the disappearance of all relief, the stomach appears as if coated with a thin layer of barium. In well defined ulcerating carcinoma, the roentgenogram shows a central niche, an evident delimitation of the tumor at the periphery, and clear-cut interruption of the folds at the neoplastic contour. Study of the mucosal relief is more important in malignant tumors, which from the beginning evolve in the form of ulcer and present a great similarity to benign ulcers. In both, there may be a halo at the base, but it is constant, appears under the slightest compression, and is of irregular shape in malignant ulcer; it is due to edema of the mucosa in benign ulcer. In half of the cases of scirrhous carcinoma, there is complete disappearance of relief or an irregular and interrupted course of the folds, but the alterations of the mucosa are not characteristic of the disorder. Of particular importance in the diagnosis of carcinoma is the presence of folds of irregular size, alternating with normal folds, between which the opaque solution runs in irregular rivulets.

The signs which permit a diagnosis of sarcoma are the persistence of peristalsis in the presence of marked filling defects with multiple localizations, the possibility of displacement of the viscus, the absence of stenosis, and the aspect of the mucosa, which resembles that found in benign tumors in the majority of cases.

Polyps are the most frequent benign gastric tumors and vary in size and location. Their roentgenological signs consist of a filling defect with smooth contour, normal relief of the mucosa around the tumor, and normal peristalsis (Fig. 2).

In roentgenological examination of the stomach for suspected changes, it is necessary to determine the seat of the lesion, to establish its extent, and to recognize its nature. These three problems are best solved by the use of a small quantity of opaque solution, which is the only means of showing early neoplastic changes and the differentiation between benign and malignant tumors with their chief anatomical characteristics. The tumor's extent gives its limits of operability. RICHARD KEMEL, M.D.

Åkerlund, Å.: Transparent, Gas-Containing Cavity Formation in Gall Stones, and Its Significance for Diagnosis (Ueber transparente gashaltige Spaltbildungen in Gallensteinen und ihre roentgendiagnostische Bedeutung). *Acta radiol.*, 1938, 19: 215.

Three cases are reported in which, upon roentgen examination of the gall bladder, additional concretions to the usual calcareous sediment findings and the heavy stones with dense shadows, or at least with denser centers, were found. These concretions were floating up on top, and showed star-shaped central figures of decreased shadow density. When removed they were found to have a specific gravity as low as 1,010 (the specific gravity of pure cholesterin is 1,040), and it is believed, because of their lightness and the great brightness of the central figures, that they must contain gas (Fig. 1).

Fig. 1. Roentgenography of the gall bladder, immediately following its extirpation. A densely calcified concrement lies in the center of the gall bladder; round about this are a number of smaller concrements, most of them with clearly discernible, central, star-shaped figures of lessened density.

Such central cleft formation has, of course, already been discussed in the literature, but so far as the author knows, no one has pointed out its significance for diagnosis, and this rarely observed phenomenon is therefore proposed by the author as a new roentgen-symptom in cholelithiasis (the symptom of the transparent gall-stone cleft formation).

JOHN W. BRENNAN, M.D.

Westermark, N., and Forssman, G.: The Roentgen Diagnosis of Tuberculous Spondylitis. *Acta radiol.*, 1938, 19: 207.

This is a study based on 275 cases of tuberculous spondylitis observed between the years 1930 and 1936, in the roentgen department of St. Görans sjukhus in Stockholm. One hundred and eight of the cases showed changes which were relatively recent, and these were allotted special study.

Of these 108 early cases, 60 presented changes which were sharply localized and 48 changes which were diffused throughout the greater portion of the vertebral body. Most of the patients in the first group (56) were more than fifteen years of age and 46 were more than twenty; on the other hand, more than half of the patients in the second group (29) were less than ten years of age and 36 were less than twenty years.

a b c

Fig. 1. Case of focal osteitis. Prominent periosteal deposits.

Of the 60 localized lesions 48 were located in the anterior portion of the vertebral body and 36 were in the lower portion; only 9 were located posteriorly, and of these 5 were located in the lower portion. The remaining 2 were located in the base of the transverse arch.

Since nearly all of these lesions were placed laterally, an oblique roentgen exposure (at 45 degrees to the sagittal plane) was recommended in addition to the regular anterior and lateral views, as it would more satisfactorily isolate the lesion on the plate for study of the processes of osteosclerosis and periostitis. By this means the author was able to distinguish two different types of focal spondylitis: the one a circumscribed osteosclerosis with periosteal deposits, and the other a type with formation of sequestrum and a rarefied border zone.

An example of the advantages of the oblique view is seen in Figure 1b. JOHN W. BRENNAN, M.D.

Massari, G. M.: Difficulties in the Roentgenological Diagnosis of Osteosarcoma (Difficoltà nella diagnosi radiologica dell'osteosarcoma). *Radiol. med.*, 1938, 25: 598.

Massari states that among the many neoplastic processes involving the skeleton, the malignant connective-tissue tumors present insurmountable diagnostic difficulties. Osteosarcoma is perhaps the most commonly observed primary tumor of bone, and it appears under so many varied aspects that the correct diagnosis can be made only by a person who has considerable experience in this field.

In this article the author bases his conclusions primarily upon the observation of a series of patients with osteosarcoma. He believes that first of all every patient should be studied as carefully as possible from a clinical point of view. The individual roentgen films should be taken as accurately as possible and should be read by a roentgenologist who has had a great deal of experience with these pathological processes. The interpretation of the film is often difficult; primary osteosarcoma should be differentiated from secondary metastatic neoplasms and from certain inflammatory processes as they are observed in lues, osteomyelitis, and periostitis.

There are a few anatomicopathological features, however, which may be of considerable diagnostic aid in the interpretation of roentgen films, such as:

(1) neoplastic formations in the bone presenting fuzzy contours with an irregular, eroded, interrupted, or destroyed cortical layer; (2) osteolytic zones in the spongious layer of the bone; (3) intense decalcification; (4) osseous tumor formations appearing in the form of bone spicules lying perpendicularly to the surface of the bone (5) invasion of the surrounding soft parts; (6) rapid growth and invasion; and (7) simultaneous participation of the entire circumference of the bone.

In benign tumors, on the other hand, the bony contours are well delimited, the cortical layer being relatively thin but not interrupted. The osseous structure is not much altered; decalcification, as a rule, is not extensive; the soft parts are not involved; and growth is slow. Unfortunately, all these differential points are not sufficient to formulate a diagnosis.

It is often difficult to interpret the presence of areas of decreased density in the bone because it may be due to a multiplicity of processes, such as decalcification, destruction of the bone and replacement by a less dense osteoid tissue, decalcification due to extensive vascularization, and finally destruction of bone due to the invasion of neoplastic cells.

It is therefore essential that the bone should be studied very carefully with reference to its internal structure as well as to its contour and surrounding soft structures.

In many cases the lesion is so advanced that treatment would be of no avail; in other cases the x-ray film reveals suspicious lesions. In the latter instance the history, physical findings, and clinical examination may lead to the correct diagnosis.

RICHARD E. SOMMA, M.D.

Jacobson, L. E., and Rosenbaum, D.: Post-Mortem Findings and Radio-Activity Determinations Five Years After the Injection of Thorotrast. *Radiology*, 1938, 31: 601.

A white female patient, aged seventy-three and with complaints of weakness, vertigo, palpitation, and dyspnea, was admitted to the hospital in May, 1937. The liver was barely palpable, and the spleen was moderately enlarged. The liver function tests were normal. In 1932 it was believed that she had atrophic cirrhosis with splenomegaly. Hepatolienography after the injection of 75 c.cm. of thorotrast at that time showed a slight enlargement of the spleen. The patient died in May, 1937, and at necropsy significant changes were found in the liver, spleen, lymph nodes, mediastinum, and femoral arteries.

The liver weighed 1,150 gm., was firm in consistency, and showed a few irregular surface depressions. On section a retracted yellowish, streaked fibrous network was found throughout. The lobules were grayish and indistinctly delineated. Hematoxylin and eosin preparations of the liver showed large masses of a thorium compound in the form of grayish-green granules. These were found largely in the portal spaces, where some seemed to lie free in the fibrous tissue, which was slightly increased. Other masses of thorium compound were found in phagocytes in the portal spaces. Some of the sinusoids appeared to be obstructed by large masses of the material which lay in swollen Kupffer cells.

The spleen weighed 180 gm., was indurated and heavy, but not firm. The pulp was red and stippled with miliary yellowish deposits. Sections of the spleen showed large collections of a thorium compound massed in and about the splenic corpuscles, which were atrophic, near the fibrous trabeculæ, and near the sheathed arterioles. In these locations the granular substance lay in large phagocytic reticuloendothelial cells. Similar cells were scattered in the pulp. Fibrous tissue was moderately increased. A lymph node from the region of the gall-bladder bed contained large masses of thorium, which were shown in germinal centers and in the recticulum throughout the lymphoid tissue. Sections revealed marked fibrosis. Mediastinal lymph nodes contained no thorium and were not fibrotic. The bone marrow showed neither thorium deposits nor fibrosis.

Measurements of radio-activity were made, and showed that there remained in the liver, five years after the injection of 75 c.cm. of thorotrast, approximately 27 per cent of the original gamma-ray activity of the thorotrast. By means of Taft's results it was found that the liver would still contain a gamma-ray equivalent of 0.37 microgram of radium. Taft had previously found 51 per cent of the original dose of radio-active material in the ash of a liver a little more than a month after the injection of thorotrast.

The authors believe that the changes described were due to the long-standing presence of thorium or its disintegration products, and that the amount of radio-active substance present was sufficient to induce the fibrotic changes seen in the liver, spleen, and lymph nodes. HAROLD C. OCHSNER, M.D.

RADIUM

Rubenfeld, S., and Schneider, T.: A New Device for Radium Application in Esophageal Malignancy. *Radiology*, 1938, 31: 554.

The authors believe that esophageal carcinoma, which is a moderately sensitive tumor and remains localized in an approachable site, should offer more chance of successful treatment than it has. They briefly review the literature on methods of radium application.

A new applicator is described, which consists of four parts: (1) capsule, (2) soft rubber tubing, (3) anchoring cord, (4) stylet and handle. The capsule is made of hard rubber; measures 8.4 cm. over all; it has a hollow body 6.2 cm. long, a hollow neck which is corrugated on the outside, and a screw tip. The capsule gradually tapers from an outside diameter of 7 mm. at its widest point to 3 mm. at the end of the blunt-nosed tip. The diameter of the hollow space is 5 mm. and the wall thickness is 1 mm. at the thickest point. In the proximal pole of the capsule is a shoul-

der separating the hollow of the neck from the hollow body of the capsule, which provides a passageway for an anchoring linen cord. Latex rubber tubing can be fitted snugly over the corrugated neck of the capsule. The stylet is made of 27-gauge piano steel wire which combines flexibility with rigidity.

In the application of this device the upper and lower levels of the lesion are marked on the patient's chest by means of ink or a skin pencil in order to indicate on the exterior the levels of the lesion for proper placement of the capsule. Before introduction of the capsule the patient abstains from food for four hours, and adequate doses of morphine and atropine are given. The nasopharynx is moderately cocainized. Two or three radium tubes are fitted to the hollow capsule. The wire stylet is lubricated and thrust into the rubber tubing, so that it lodges upon the shoulder in the capsule. The applicator is inserted with the patient sitting upright and his head completely extended; pressure is brought to bear very gently until the tumor mass is reached. The sensation of the mass is easily transmitted to the finger. The moment the lesion is passed the sensation of all resistance disappears. It is essential to reach a level below the lesion, following which the stylet is withdrawn, the rubber tubing and anchoring cord remaining in place. The patient is then examined by means of the fluoroscope and the capsule is drawn upward to the level previously determined by the marks on the chest. Barium should not be administered during or following the introduction of the tube.

To date the authors have used 2 or 3 10-mgm. tubes of radium with filtration of 1 mm. of platinum. The sound is permitted to remain *in situ* from twenty-four to forty-eight hours, a dose of from 480 to 1,440 mgm. being thereby obtained. A second application is made within several days, and if the condition of the patient is good, insertions are repeated at three-day intervals until from 4,000 to 5,000 mgm.-hr. are given. During the period that the radium is in place, 1 oz. of olive oil (3 times daily), sodium bicarbonate, and sedatives are given. Liquids, such as milk, eggnog, and whiskey, are given also. Three cases in which the applicators were used are reported. HAROLD C. OCHSNER, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Opsahl, R.: The Pathogenesis of Arterial Hypertension, with Special Regard to the Rôle of the Kidneys and Adrenal Glands in the Production of "White" High Blood Pressure (Zur Pathogenese der arteriellen Hypertension unter besonderer Berucksichtigung der Rolle der Nieren und Nebennieren im Mechanismus des weissen Hochdrucks). *Acta med. Scand.*, 1938, Supp. 92.

This monograph on the pathogenesis of high blood pressure is among the longer treatises of foreign origin to appear in 1938. While Opsahl hesitates to minimize the importance of animal experimentation in the study of the cause of hypertension, he makes it clear that he believes, with many other clinicians of his acquaintance, that the solution of the problem is to come about through a detailed study of large series of clinical cases. His paper is essentially a summary of, first, the current ideas relative to the nature of hypertension, and, second, of his own clinical observations.

His interest is directed principally toward the function of the adrenal glands. He believes that there are three distinct forms of arterial hypertension: the purely "constitutional" type, with the clinical picture of Volhard's "red" hypertension; a purely renal form; and a combined constitutional-renal form, the latter two types falling under the old classification of Volhard's "white" hypertension, comparable in part to the modern conception of "essential hypertension." These two forms with the renal component are to be explained by the fact that when the filtration mechanism of the kidneys is impaired, be it either because of intrinsic disease of the kidneys (glomerulonephritis, nephrosclerosis, renal arteriosclerosis), or because of failure of the rest of the cardiovascular mechanism, a higher head of pressure in the glomeruli is needed to provide a filtration efficiency compatible with life. This increased pressure is brought about by a hyperactivity of the adrenal glands, with a resultant general increase in vascular tone and cardiac efficiency. The author finds support for this belief in Cannon's original conception of the "emergency function" of the adrenal glands.

Opsahl has avoided any suggestions as to the rational treatment of hypertension. The references to the literature are numerous and well selected.

JOHN MARTIN, M.D.

Heymans, C.: Some Aspects of Regulation of the Blood Pressure and Experimental Arterial Hypertension. *Surgery*, 1938, 4: 487.

This short report is a concise statement of Heyman's experimental approach to the subject of hypertension, of his pertinent physiological findings, and, briefly, of his conclusions, together with those of his several collaborators. Heyman has for many years studied the physiology of the carotid sinus and the cardio-aortic nerves, which he terms the "buffer or moderator nerves" of the blood pressure. He has repeatedly shown that section or depression of the nerves causes a marked increase in the blood pressure as a result of "the release of the vasoconstrictor and cardio-accelerator centers, the activity of which, under normal conditions, is permanently moderated reflexly by the aortic and carotid sinus nerves." He believes that this "moderator" activity of these nerves is controlled by means of the pressure and the chemical constitution of the blood, since these two factors act on the pressosensitive and chemosensitive nerve endings of the cardio-aortic and carotid sinus vascular areas. The severity of a hypertension resulting after destruction of these nerves seems to depend principally upon the sympathetic vasopressor tone, and Heymans finds that complete removal of the sympathetic chain and ganglia from the stellate to the pelvic ganglion in the dog prevents or cures this type of experimental hypertension.

Heymans does not know just where, in relation to the hypertension of human subjects, to place the hypertension produced by destruction of the sinus-moderator nerve. To him, it resembles "essential neurogenic hypertension" rather than the nephropathic variety. He did note, however, that the carotid-sinus vasopressor and hypertensive reflexes were especially active in the Goldblatt type of dog.

JOHN MARTIN, M.D.

Goodman, M. H.: Chronic Streptococcic Ulcer of the Skin. *J. Am. M. Ass.*, 1938, 111: 1427.

Reports of chronic ulceration of the skin, in which the streptococcus plays a primary etiological rôle, cannot be found in the literature. In streptococcic pustular dermatosis the organism is present only in the purulent exudate, and ceases to be active when free drainage is accomplished and cleanliness is maintained by the local application of antiseptics. The type of ulcer which forms the basis of this report is unique in that it was produced by streptococci; presented features of chronicity, both clinically and histologically; and occurred on the skin of healthy individuals.

The author presents the complete history in two cases, with a report of his bacteriological and histological studies. In the first case, ulcers appeared on the forearm and leg of the patient; in the second case, the ulcers appeared on both legs.

In both cases there were found a variety of beta hemolytic streptococcus capable of producing a low grade of necrosis leading to chronic ulceration. The organism proved to be a streptococcus pyogenes of human strain, which, when accidentally transferred to the skin, produced an area of redness and edema,

and became softened and necrotic. The resulting ulcer was superficial and, upon early treatment with locally applied antiseptics, healed quite rapidly. If ulcers of this type are not interfered with, the streptococcus may invade deeply and produce an undermining of the tissues, with slowly progressive extension of the ulcer.

In both cases the ulcers had enlarged; they were irregular, firm, thick, and red, with a ragged, undermining border, an uneven deepening of a roughly granular glazed base, and were discharging a serous fluid. There were no complications other than a slight and transient regional lymphangitis. Biopsy studies revealed the presence of intracellular and extracellular cocci in pairs and short chains. Various types of media were inoculated with exudate from the ulcers and a pure culture of streptococcus was obtained.

In the first case, it was impossible to effect healing by means of locally applied antiseptics, although this type of treatment was tried for a period of nearly three months. Failure to heal was unquestionably due to the fact that the organisms, enclosed in a chronic, fixed tissue infiltrate in the region of the undermined portion of the ulcers, were beyond the reach of the various agents applied. The effect of sulfanilamide on the ulcers was sharp and prompt, which solved the problem of therapy.

In the second case, each of the leg ulcers was about four times the size of those in the first case. The bacteriological and histological findings were identical with those in the first case. The effect of sulfanilamide on these ulcers was likewise prompt.

Charts showing the dosage of sulfanilamide given, with notes as to its effect on the ulcers, are presented. A definite change was noted in the appearance of the ulcers after from two to three days of sulfanilamide therapy. HARVEY S. ALLEN, M.D.

Kracke, R. R.: The Relation of Drug Therapy to Neutropenic States. *J. Am. M. Ass.*, 1938, 111: 1255.

Approximately 80 per cent of drug-produced agranulocytosis is caused by the administration of aminopyrine or one of its compounds; a lesser percentage is caused by the administration of dinitrophenol, arsephenamine, sulfanilamide, and novaldin.

The incidence of the disease is decreasing in the United States, probably because of the more cautious use of aminopyrine by the medical profession. The disease has practically disappeared from Denmark, because aminopyrine is no longer used in that country.

The number of cases of agranulocytosis from the use of sulfanilamide will probably increase in the future, particularly if this drug is incorporated in patented remedies and indiscriminately sold to the public under non-informing names.

Physicians should attempt to prevent this disease by caution in the use of these drugs, by instruction of patients concerning their purchase in drug stores, and by programs of public instruction.

SAMUEL KAHN, M.D.

Lyons, C., and Mangiaracine, A.: The Effect of Sulfanilamide upon Human, Virulent Hemolytic Streptococci. *Ann. Surg.*, 1938, 108: 813.

Lyons reviews the literature briefly and interprets the data so far published to indicate that the probable mechanism of sulfanilamide action on hemolytic streptococci is to alter the capsule of the organism in such a way as to render it susceptible to phagocytosis. In this way it is inferred that the effect of sulfanilamide is essentially similar and supplementary to that of specific antibacterial antibody.

Experiments are reported which are designed to show that serial subcultivation of virulent hemolytic streptococci in sulfanilamide containing media results in loss of some of the characteristics of virulence, namely, resistance to phagocytosis, resistance to spontaneous agglutination, and resistance to the bactericidal action of whole human blood. It is noted that the addition of "antibacterial antibody" to whole human blood containing sulfanilamide increases the streptococcidal capacity.

On the basis of his clinical experience, Lyons believes that sulfanilamide will be effective in invasive human streptococcic infections only when the patient possesses (either through spontaneous development or immunotransfusion) specific antibacterial antibody. [His technique for selecting donors for immunotransfusions was described in the *J. Am. M. Ass.*, 1935, 105: 1972.] He recognizes, however, that there is variation in the susceptibility to sulfanilamide among strains of hemolytic streptococci and that some strains may be so altered by exposure to sulfanilamide as to be killed by human blood even in the absence of specific antibody. Effective treatment for patients with sustained bacteremia and no antibody should consist of sulfanilamide medication and the intravenous administration of specific antibacterial antibody by the immunotransfusion technique. JOHN S. LOCKWOOD, M.D.

DUCTLESS GLANDS

Thorn, G. W., Emerson, K., Jr., and Eisenberg, H.: Oral Therapy in Adrenal Insufficiency. *Endocrinology*, 1938, 23: 403.

Attention is called to a report by Osler in 1896 of the successful use of a glycerol extract of fresh adrenal tissue in the treatment of Addison's disease. The authors have investigated the effect of the oral administration of a concentrated extract of adrenal cortex preserved in glycerol (1 c.cm. representing 50 gm. of fresh adrenal cortex) in patients with Addison's disease and in bilaterally adrenalectomized dogs. A decrease in the renal excretion of sodium and chloride and an increased potassium excretion resulted. "Glycerol-extract treatment prevented the usual sodium and chloride diuresis which follows bilateral adrenalectomy in the dog. Bilaterally adrenalectomized dogs were maintained successfully on the glycerol preparation for prolonged periods. In man and dog the ratio of the amount of extract administered twice daily by mouth as compared to

extract administered twice daily by injection is approximately 2.5:1. No toxic effects were observed from the administration of 10 to 20 c.c. of glycerol per day. Extract, administered orally, should not be used in the treatment of acute Addisonian crisis."

WALTER H. NADLER, M.D.

HOSPITALS; MEDICAL EDUCATION AND HISTORY

Hart, D.: Pathogenic Bacteria in the Air of Operating Rooms: Their Widespread Distribution and the Methods of Control. *Arch. Surg.*, 1938, 37: 521.

In 1937 Hart published a report on the use of bactericidal radiant energy in operating rooms as a means of preventing infections by air-borne organisms (*Arch. Surg.*, 1937, 34: 874). The validity of his conclusion that most operative infections were due to air-borne contaminants was challenged in certain quarters. Thereupon the author obtained the co-operation of 33 hospitals in 17 states for the study of bacterial flora in the air of operating rooms. This article is a report of the study, and includes a tabulation of the data sent in by the various hospitals, together with the author's comment.

The average counts of bacteria were lowest in operating rooms which were equipped with air-conditioning systems, but even these averaged 35 colonies per hour of exposure of an agar plate. Hart claims that with the addition of bactericidal irradiation the number of colonies per plate per hour can be reduced to one or less. The numbers of bacteria in the air increase in proportion to the number of occupants, particularly when one or more of the occupants has a respiratory infection. The majority of the pathogenic organisms recovered were staphylococci, streptococci being found only occasionally.

The author concludes: (1) that pathogenic bacteria floating in the air and universally present in the occupied room are the greatest cause of infection in clean incisions in the modern, well-run operating room; (2) that air conditioning with forced ventilation will reduce the degree of contamination of the air, but will leave large numbers of circulating bacteria in the vicinity of the wound and the sterile supplies, most of them derived from the operating personnel; (3) that bactericidal irradiation of the air in the operating room is the only method available of achieving further reduction of air-borne infection.

JOHN LOCKWOOD, M.D.

Nisbet, O. M., and Brooke, J. W.: The Incidence of Air-Borne Bacteria in the Major Surgery of the Multnomah County Hospital (Oregon). *Surgery*, 1938, 4: 755.

The number of air-borne bacteria in the major surgery of Multnomah County Hospital is roughly proportional to the number of people in the surgery and to the activity on the floor proper of the surgery. The greatest proportional rise in incidence is manifested by the streptococci and the staphylococcus albus. The organisms showing this rise are acknowledged to be common inhabitants of the nasopharynx.

The estimated number of bacteria falling per hour on a sterile operating field compares unfavorably with similar figures obtained in other hospitals.

SAMUEL KAHN, M.D.